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AUTHOR Mukai, Gary; Kim, Pearl; Li, Alan; Chenette, Sara
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ABSTRACT

This curriculum unit explains that currently Asia has 9 of the world's 14 megacities (a city with a population of 10 million people or more) and that by the year 2015 there will be 27 megacities with 17 of them in Asia. The unit introduces students to several megacities in Asia and uses these cities as examples for understanding the ecological impacts a megacity has on its surrounding environment. The unit contains six lessons: (1) "Megacities and Air Pollution" (students examine what a megacity is, where megacities are located in the world, how graphs can be used to analyze trends, and the effects one region's air pollution has upon another geographic region); (2) "Energy and Society" (students explore the characteristics of energy use in the megacities of Beijing, Mumbai, and Manila; how energy use affects society and personal lifestyles, and the characteristics of high- and low-energy use societies; and guidelines for preparing brief overviews of the cities and presenting them to the class); (3) "Bangkok and the Scope of Water Pollution" (students discover various perspectives of Bangkok's water pollution problems and the ways the perspectives are interdependent, and the significance of water in Thai culture); (4) "Waste Management in Tokyo" (students learn the major ways people in Tokyo dispose of waste, the viability of these methods, and the similar methods that exist in students' home communities); (5) "Urbanization in Asia: Key Actors--Their Roles and Concerns" (students analyze the significance urbanization has on the environment of Asia, and the roles and concerns of key actors involved with environmental issues); and (6)

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"Sustainability of Megacities" (students examine the major environmental problems facing Asia, the major underlying causes of environmental degradation, and solutions to reducing environmental degradation). The appendices include sustainability game panels, sustainability game environmental IQ cards, color transparencies that show the energy use per capita for 1994, and the annual sulfur deposition for 1990. Handouts are included with each lesson. (BT)

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SPICE

Focusing on Their Environmental Impact



Center for Global Partnership,
The Japan Foundation

Consulate General of Japan, San Francisco

Institute for International Studies,
Stanford University

Japan Fund, Stanford University

Stanford East Asia National Resource Center

MEGACITIES IN THE ASIA/PACIFIC REGION: FOCUSING ON THEIR ENVIRONMENTAL IMPACT

Developed by Gary Mukai, Asia/Pacific Project Director, Pearl Kim, Curriculum Specialist
and Research Assistants Alan Li and Sara Chenette

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For further information contact:
Stanford Program on International and Cross-Cultural Education
Institute for International Studies (IIS)
Littlefield Center, Room 14, Stanford University, 300 Lasuen Street,
Stanford, CA 94305-5013
Tel: (800) 578-1114
Fax: (650) 723-6784
E-mail: SPICE.Sales@Forsythe.Stanford.Edu

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TABLE OF CONTENTS

unit introduction

MEGACITIES IN THE ASIA/PACIFIC REGION	
Focusing on Their Environmental Impact	1
Rationale and Introduction to Lessons.....	1
Unit Goals.....	3
Materials	4
Time, Suggested Sequence of Activities	4
Small-Group Roles	4
Grade Levels	4
Subjects	4
Equipment.....	5
Icons	5

lesson one

MEGACITIES AND AIR POLLUTION	7
Handout #1	
Boomtown Bound	13
Discussion Cards	
Boomtown.....	17
Class Discussion Summary	
Boomtown.....	19
Transparency	
World Map.....	20
Transparency	
Megacities of the World, 1994 (without megacity names).....	21
Transparency	
Megacities of the World, 1994 (with megacity names)	22
Transparency	
Projected Megacities of the World, 2015.....	23
Transparency	
Top Ten Most Populated Megacities of the World, 1994 and 2015	24
Group Project Handout #1	
Kenji: What Happened to the Fish?	25
Group Project Handout #2	
Air Pollution.....	26
Group Project Handout #3	
Beijing and Tokyo Air Pollution Graphs	27

lesson two

ENERGY AND SOCIETY	29
For the Teacher	
Discussion Points for World Energy Map	34
Handout #1	
Beijing: Living with Coal	35
Handout #2	
Mumbai: Nuclear Problems	38
Handout #3	
Manila: Geothermal Options	41
Handout #4	
Thinking It Through	44
Handout #5	
An Energy Theory	46
Transparency	
Summary Chart	49

lesson three

BANGKOK AND THE SCOPE OF WATER POLLUTION	51
For the Teacher	
Geographic Features of Bangkok	59
Handout #1	
The History and Politics of Water	60
Handout #2	
Causes and Effects	62
Handout #3	
Comprehension Questions	63
Handout #4	
Coping with Population and Industrial Growth	64
Handout #5	
Comprehension Questions	66
Transparency	
Summary Chart	67
For the Teacher	
Web Diagram	68
Handout #6	
Creating Meaning with Water	69
Handout #7	
Life on Water	71

lesson four

WASTE MANAGEMENT IN TOKYO	73
Handout #1	
Developing a Garbage-Sorting Plan	78
Handout #2	
Tokyo Waste Management Summary	79
Handout #3	
Management Method Sorting Chart	82

Handout #4	
Group Paper Planning Sheet.....	83

lesson five

URBANIZATION IN ASIA:	
KEY ACTORS—THEIR ROLES AND CONCERNS	85
Handout #1	
Urbanization.....	91
Transparency	
Growth of Urban and Rural Populations in Asia, 1965–2025 ...	92
Transparency	
Asia's 13 Largest Cities.....	93
Transparency	
Urban Agglomerations with Populations of 10 Million or More, 2015.....	94
Handout #2	
Economic-Environmental Typology of Cities.....	95
Handout #3	
Key Actors—Their Roles and Concerns	96
Megacity Information Sheet #1	
Karachi, Pakistan.....	97
Megacity Information Sheet #2	
Jakarta, Indonesia	99
Megacity Information Sheet #3	
Seoul, Republic of Korea.....	100
Key Actors #1	
Environmental Protection Agencies.....	101
Key Actors #2	
Planning Agencies	102
Key Actors #3	
Politicians.....	103
Key Actors #4	
Public Works Departments.....	104
Key Actors #5	
Concerned Residents and Community-Based Organizations.....	105
Key Actors #6	
Non-Governmental Organizations.....	106
Key Actors #7	
Private- and Informal-Sector Enterprises.....	107
Key Actors #8	
The News Media.....	108
Key Actors #9	
The Scientific and Engineering Community	109
Key Actors #10	
External Support Agencies	110

lesson six

SUSTAINABILITY OF MEGACITIES.....	111
Handout #1	
Megacity Trends.....	115

Handout #2	
Areas of Environmental Concern:	
Water, Air, Waste, and Land Use.....	117
Handout #3	
Underlying Causes of Environmental Degradation.....	120
Handout #4	
Suggested Courses of Action	122
For the Teacher	
Possible Solutions to Reduce Environmental Degradation	125
Instructions	
Sustainability Game	128
Setup Guide	
Sustainability Game	129
Score Sheet	
Sustainability Game	130
For the Teacher	
Sustainability Assessment.....	131

appendices

Sustainability Game Panels	
Sustainability Game Environmental IQ Cards	
Color Transparency	
Energy Use Per Capita, 1994	
Color Transparency	
1990 Annual Sulfur Deposition (grams S/m ²)	

Unit Introduction

MEGACITIES IN THE ASIA/PACIFIC REGION: FOCUSING ON THEIR ENVIRONMENTAL IMPACT

Rationale and Introduction to Lessons

"When you think of the sustainability of a megacity like New York or Tokyo, you must think in global terms. We need to consider the footprint of these megacities—what impact does their presence have on everyone else? What is the environmental trace that they are leaving, not only in terms of extraction of natural resources, but in terms of output, pollution, waste... If we are talking about a global village, it is irresponsible not to begin to do that environmental arithmetic... What is the cost of keeping these giant habitats of mankind functioning and metabolizing?"

—Wally N'Dow, Secretary-General of the United Nations' Habitat II Conference (quoted in "The First Urban Century: The Past Is Too Small to Inhabit," *New Perspectives Quarterly*, June 22, 1996, p. 10)

Roughly half of the world's population now lives in cities, and each day about 250,000 more people are added to the world community. By current estimates, this growth will double the world's population to more than 10 billion people by the year 2025. In this curriculum unit, a megacity is defined as a city with a population of 10 million people or more, either currently or projected by the year 2000. Currently Asia has nine of the world's fourteen megacities. If these trends continue, there will be more than twenty megacities in the world by the year 2000. By the year 2015 there will be twenty-seven with seventeen of them in Asia. The largest, Tokyo, will have a population of 28.7 million and may be part of an uninterrupted urban sprawl through Yokohama in the east to as far west as Nagoya or Osaka.

Population growth is not the only factor in the formation of megacities. Economies of scale make electricity, water, sewer, and garbage costs lower in a city than in a rural area. This is particularly attractive to the industries of developing nations where cities of more than one million people doubled from 49 to 112 from 1950 to 1995. As industries concentrate in urban areas, people are drawn to them by the perceived opportunities and services they might provide. They are also displaced from traditional farms by factors such as increased mechanization of agriculture. This creates a strong migration trend toward cities that not only swells megacity populations, but also

unit introduction

changes some of the fundamental habits (such as diet) of the rural people making this transition.

As Wally N'Dow's quote suggests, it is important to look at the impact these megacities have on the world environment. The purposes of this unit are to introduce students to several megacities in Asia and to use these cities as examples for understanding the ecological concerns a megacity raises for its surrounding environment. Six lessons cover the following topics: air quality, energy resources, water resources, waste management, general effects of urbanization, and sustainability of megacities. In studying these issues affecting megacities, students will gain the skills necessary to understand the environmental problems associated with not only cities of millions of people but smaller communities as well.

In lesson 1, students examine reasons why large cities form in a country such as China, as well as consider the advantages and disadvantages of megacities (i.e., cities with a population of 10 million or more either currently or projected by the year 2000) and explore what qualities a city of over 10 million might have. Students also identify megacities they know about and locate them on a world map. Students will learn how to represent numbers in a graphical form and gain practice reading graphs. Finally, students will gain an understanding of air pollution issues in Beijing and how air pollution in China might affect Japan.

Lesson 2 consists of three activities. The first activity has students explore energy use in the megacities of Beijing, China; Mumbai (formerly Bombay), India; and Manila, Philippines. Students read about the historical background of these cities and people's lives in relation to energy. In the second activity, students continue their exploration of these megacities by preparing brief overviews of the cities and presenting them to the class. In the third activity, students brainstorm and identify elements of a sociological theory about energy use that distinguishes between high- and low-energy societies. Students relate what they have learned about high-energy and low-energy societies to similar behavior and values that can be found in their own lives.

Lesson 3 examines water as a megacity resource. The lesson explores the historical, political, and economic aspects of water in Bangkok, Thailand. Water pollution is examined from the perspectives of population and industrial growth, and its causes and effects are analyzed as well. A final activity focuses on Thai culture and some of its traditions involving water, and students are encouraged to think about how these traditions might be threatened by water pollution.

Lesson 4 explores waste management and sanitation. In this lesson, students will learn about different types of garbage that humans produce as well as look at ways of sorting this garbage into categories. Next, students will learn how people in the megacity of Tokyo, Japan, the only Asian megacity in the developed world, deal with the different types of garbage produced. The characteristics of each method are explored as well as the potential for long-term use.

unit introduction

Finally, students will look at their own production of garbage and how it might be disposed of in their community.

Lesson 5 introduces students to the effects of urbanization on a population. The first part of lesson 5 explores current trends in urbanization in Asia. In the second part of the lesson, students are introduced to the notion that the nature of urban environmental problems is determined in large part by the interaction of numerous public, private, non-governmental, community, and household actors. Students role-play these various actors and consider strategies for raising awareness of urban environmental management in the megacities of Jakarta, Indonesia; Karachi, Pakistan; and Seoul, Republic of Korea. Students develop ten-year plans for these megacities and participate in a Megacity Summit.

Lesson 6 examines the sustainability of megacities. The lesson can be taught in isolation of the first five lessons of the curriculum unit, since it offers an overview of megacity trends, concerns about the sustainability of megacities, underlying causes of environmental degradation, suggested actions and priorities, and possible solutions. Important information from these overviews are incorporated into a board game called Sustainability. Students play this game in small groups while considering the environmental impact of megacities.

Unit Goals

Each of the six lessons in this curriculum unit has specific learning objectives listed. These objectives have been divided into knowledge, attitude, and skill objectives for students. The following list reflects goals for the curriculum unit as a whole.

In this curriculum unit, students will:

- learn about the geography of Asia and the Pacific
- learn about the formation of megacities and their importance to industrialization in developing countries
- learn about the major environmental problems facing Asia
- examine how air pollution from one megacity can cross international borders and affect other countries
- understand energy needs and the pollution caused by the conversion of energy resources to industrial and domestic uses
- examine characteristics of high- and low-energy use societies
- gain an understanding of the multifaceted issue of water pollution
- learn to evaluate waste management options critically
- examine the significance of urbanization on the environment of Asia
- consider some of the roles and concerns of key actors involved with environmental issues
- consider the major underlying causes of environmental degradation
- consider solutions to reducing environmental degradation
- develop a sense of personal, national, and international responsibility for the environment

unit introduction

- understand the impact of population growth on environmental pollution
- learn to think critically and make informed opinions
- evaluate policy issues
- interpret statistics and graphical information
- work effectively in small and large groups

Materials

Handouts and primary source documents have been provided with each lesson to present students with a range of perspectives on the topic being studied. Permission is given to reproduce these handouts and documents for classroom use only. A list of materials is provided in each lesson.

Time, Suggested Sequence of Activities

Megacities in the Asia/Pacific Region: Focusing on Their Environmental Impact is divided into six lessons. We recommend two class periods for each lesson. The various activities have been designed to give students multiple perspectives on the topic being studied.

Small-Group Roles

Megacities in the Asia/Pacific Region: Focusing on Their Environmental Impact engages students in many small group activities. Some of the suggested roles and responsibilities for students working in small groups are:

- **Facilitator:** responsible for reading instructions or designating someone in the group to read instructions, for assuring that the group is on task, and for communicating with the instructor
- **Recorder:** responsible for writing answers to questions, taking notes, etc.
- **Timekeeper:** responsible for keeping track of the time allocated for activities
- **Materials Manager:** responsible for obtaining and keeping track of materials used by the group
- **Harmonizer:** responsible for the group process, making sure, for example, that no one dominates the discussion and that everyone is participating
- **Reporter:** responsible for organizing group presentations and presenting results of activities to the class

Some lessons in this curriculum unit have other specific small-group roles listed by individual lesson.

Grade Levels

Grades 7-12

Subjects

This curriculum unit is recommended for use in social studies, environmental studies, science, Asian studies, and contemporary issues classes.

unit introduction

Equipment Overhead projector
Computer for access to the World Wide Web (optional)

Icons For easier reference, the following icons are used throughout the unit:



Notes to the Teacher



Student Cards



Homework



Small-Group Activity



Transparency

Lesson 1

MEGACITIES AND AIR POLLUTION

Organizing Questions

- What is a megacity?
- Where are megacities located in the world? in Asia?
- How can graphs be used to analyze trends in a set of numbers?
- Can air pollution in one geographic region affect another?

Introduction

"Many of the major cities of the world are beset by a series of environmentally related problems, not the least of which is their deteriorating air quality. Exposure to air pollution is now an almost inescapable part of urban life throughout the world." (World Health Organization, *Urban Air Pollution in Megacities of the World*, p. 1)

This lesson consists of three parts. In part 1, students examine reasons why large cities form in a country such as China, as well as consider the advantages and disadvantages of megacities (i.e., cities with a population of 10 million or more, either currently or projected by the year 2000) and explore what qualities a megacity might have. Students also identify megacities and locate them on a world map.

In part 2, students learn how to represent numbers in a graphical form and gain practice reading graphs. Finally, in part 3, students examine air pollution issues in Beijing and consider how air pollution in China might affect Japan.

Objectives *knowledge*

- to increase student awareness of global integration and global interdependence
- to appreciate the complexity of factors that contribute to the population migration within a country along with associated advantages and disadvantages to migrant workers
- to locate megacities in the world on a world map
- to recognize trends in megacity population patterns
- to understand basic issues of air pollution in Beijing and their effects on other countries

attitude

- to appreciate differences in outlook among different countries

lesson one

- to learn to view issues of air pollution from multiple perspectives
- to critically appraise and evaluate the opinions of others
- to provide alternative views or explanations of an issue

skill

- to interpret and analyze information contained in a graph
- to articulate personal opinion in a group discussion
- to work harmoniously in small groups using effective listening and conversational skills
- to recognize relevant social and environmental issues contained in a newspaper article
- to create a position on a topic and express this position in discussion, through writing, and by constructing a poster

Materials

- Handout #1, Boomtown Bound, one per student
- Boomtown Discussion Cards, one copy cut into six cards
- Boomtown Class Discussion Summary, transparency
- World Map, transparency
- Megacities of the World, 1994 (without megacity names), transparency
- Megacities of the World, 1994 (with megacity names), transparency
- Projected Megacities of the World, 2015, transparency
- Top Ten Most Populated Megacities of the World, 1994 and 2015, transparency
- Group Project Handout #1, Kenji: What Happened to the Fish?, one per group of four students
- Group Project Handout #2, Air Pollution, one per group of four students
- Group Project Handout #3, Beijing and Tokyo Air Pollution Graphs, one per group of four students
- Sulfur Deposition Map, color transparency (included with curriculum unit)
- Butcher paper and colored pens for posters



By the year 2025, United Nations projections place the world's population at over 10 billion people. Over half of this population will be in large cities. Asian cities are growing faster than other regions of the world. Currently, Asia has nine of the world's fourteen megacities. In this curriculum unit, a megacity is defined as a city with a population of 10 million or more, currently or projected by the year 2000. By the year 2015, Asia will have seventeen of twenty-seven megacities in the world.

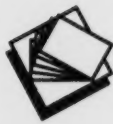
lesson one

Part of the reason for the growth of a megacity is the migration of a country's population from rural to urban areas. Different socio-political groups within a country have different reasons to promote this migration. There are economic advantages such as concentration of labor and resources for national governments. There are personal advantages for the individual such as the excitement of living in a large city and higher urban wages. Multinational companies may also benefit from the low-wage labor.

However, there are disadvantages to moving to an urban area. Living conditions are often poor. Sanitation and the concentration of pollutants are major concerns. There is also the danger that the economic benefits of the workers' labor will flow to local governments and multinational companies instead of to the workers themselves.

Procedure— Part 1

1. Divide the class into six groups. Distribute Handout #1, Boomtown Bound, to each student. Explain that the students will read a personal story describing the journey of a teenager from a small village to a large town in southern China.



Distribute one Boomtown Discussion Card to each group. The students should work together to find information about the topic contained on their card. Specific examples from the story should help illustrate each of their ideas.



2. Using the transparency, Boomtown Class Discussion Summary, have student volunteers fill in each space with ideas generated in the groups. Focus on making distinctions between the six topics covered. If possible, have the class generate additional spaces in the summary chart for their ideas. Are there any topics that should have been included but weren't?
3. Have students write their own personal definitions of what a large, growing city is, based on the class discussion of the article. Have them include advantages and disadvantages to forming them, and who benefits and how. Have students share these definitions as a class and try and come up with a class definition. Discuss how they might learn from the large-scale advantages and disadvantages found in a large city to make decisions about their own communities.

lesson one



4. Give students the definition (used in this curriculum unit) that a megacity is a city with a population of 10 million or more, currently or projected by the year 2000. Have each group suggest one or two cities that might make it in the top ten most populated cities in the world. Using the transparency, World Map, have students locate these cities. Using the transparency, Megacities of the World, 1994 (without megacity names), have students try and identify each city. Use the transparency, Megacities of the World, 1994 (with megacity names), to verify the megacities identified by the students. In addition, ask each group to suggest one or two other cities that are projected to be megacities in 2015. Use the transparency, Projected Megacities of the World, 2015, to compare with the students' responses.
5. Using the transparency, Top Ten Most Populated Megacities of the World, 1994 and 2015, discuss what trends might occur from 1994 to 2015. Why were their answers close or far from the official estimates?

Procedure— Part 2: Graphing

1. Review the trends in Asian population growth and the formation of megacities from the previous activity. Write the 1994 population of New York on the board and ask students for other ways to represent the number graphically. (The idea is to have students brainstorm other ways of representing numbers, including visual representations. Be prepared to consider and develop a wide variety of answers. Eventually, the discussion should move toward an organized visual representation such as a number line or a *scale of measurement*.)
2. Using a number line (scale), have several students experiment in front of the class with different ways of representing the population of New York. For example, students might draw a single point on the number line, or a bar or even a stack of people alongside it. Comment on the different ideas and tell the students that all are alternative ways of visually representing the population of New York.
3. Finally, write the 1994 populations of Seoul, Shanghai, and Tokyo on the board and have the students make comparisons between the three populations (largest to smallest, a few millions difference, more than double, etc.). Have the students use a number line (scale) and three bars to graph these populations at their desks. Have some students share their graphs with the class and explain whether they could see the relations between the numbers quicker and more accurately with the visual representation than just with the numbers alone.
4. Explain that when you place these bars (each representing a single number) side by side, you have a *bar graph* or *histogram*. It can be used to quickly see relationships between a group of numbers representing similar things.

lesson one

5. Write the populations of Tokyo for 1994 and 2015 on the board. Do the same for Bombay (Mumbai), India. Ask some students to make up a graph that shows how the populations are increasing. (Again, develop as many ways to graphically depict the numbers as the students come up with, but eventually lead the discussion a *line graph*—a vertical line for population connected at a right angle to a horizontal line for years.) Explain that by looking at the slope of the line connecting the two points, it is possible to see steeper slopes as greater rates of increase. Also, you can even make a prediction of where the population will be in 2016, 2020, etc., by moving along the slope to where it lines up over those years and estimating the population at that point. You might ask the students if predictions will be accurate the farther out you go. Ask what might make the predictions more accurate (more data points, etc.).



Urban air pollution is a serious problem in Asia. The three main pollutants are greenhouse gases, sulfur and nitrogen chemicals produced by the burning of fossil fuels such as coal, and tiny bits of carbon and heavy metals also known as particulate matter.

Because weather patterns can spread these pollutants far from their original sources, pollution in one country can quickly become an international problem. Therefore, if the pollutants travel from one country to another, it is in the interest of both countries to clean up the sources of pollution regardless of what country the pollution originates from.

Greenhouse gases trap heat in the earth's atmosphere, leading to a rise in global temperatures. Sulfur and nitrogen chemicals form acid rain that damages plant and animal life. Acid can also damage the surfaces of monuments and buildings. Particulates play a role in respiratory diseases.

Procedure— Part 3: Air Pollution



1. Divide the class into groups of about four students each. Distribute copies of Group Project Handout #1, Kenji: What Happened to the Fish?; Group Project Handout #2, Air Pollution; and Group Project Handout #3, Beijing and Tokyo Air Pollution Graphs, to each group. Also, project the color transparency, Sulfur Deposition Map, so all groups can refer to it. Allow students a class period to work on part 1 of the Group Project (see Group Project Handout #1).
2. Bring the class back together and reserve space on the classroom board for a chart with the following topics on air pollution: common pollutants, sources, effects, and ways to prevent them. Make sure that each group has a chance to fill in part of the chart and participates in a general discussion about findings. Two points to make sure they cover are: (1) Air pollution from one megacity can cross international borders; (2) Countries with financial resources may have an advantage in protecting the environment. These countries might help poorer countries to

lesson one

control their pollution and prevent the spread of the poorer countries' pollution across their borders. Encourage them to think of solutions to this problem (e.g., taking on part of the cost of a neighboring country's power plants). Help students generalize to their own situations. What air pollution sources might there be in their own communities?

3. As a follow-up activity, have each group work on preparing part 2 of the Group Project.

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BOOMTOWN BOUND

A Teenager's Journey Mirrors Inner Migration That's Changing China
For Her, an Arduous Ride Ends in a Job Making Heads for Barbie Dolls
'Life in the Village Is Empty'

by Kathy Chen (*The Wall Street Journal*, October 29, 1996)

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ON THE ROAD TO CHANGAN, CHINA— Hong Xiaohui has endured the hunger and the vomiting, the endless days and sleepless nights aboard a crowded, stinking bus. It is only when the bus is hours outside of a south China boomtown where a coveted factory job awaits her that she finally snaps.

Watching the bus drivers wolf down breakfast at a filthy restaurant, Ms. Hong, 18 years old, starts to weep. Her sense of injustice is raging. The restaurant owner has dragged another young woman, weak from motion sickness, off the bus in an attempt to force her and nearly 100 other would-be factory workers to shell out their scarce money for a meal.

"We paid for the trip. We should decide where to stop and whether we want to stay on the bus," Ms. Hong fumes. The drivers and restaurant workers laugh, boldly looking her over. "Why's a pretty one like you making such a fuss?" one man says, leering.

It's a telling moment for Ms. Hong. Young, full of dreams and ideals, she rushed to sign up when labor officials came to her farming village in remote Sichuan province to hire workers for Mattel Inc.'s Barbie-doll factory about 1,200 miles away in Changan, a town in Guangdong province. She even persuaded her two best friends to accompany her, promising adventure and easy money.

Now, all she feels is the reality of having only a few yuan left in her pocket, the ache in her empty stomach—and a strong, sudden longing for home. "People in the village aren't like this, just doing things for money," she says with a sigh.

Hers is a journey that millions of Chinese make every year, a sojourn of vital importance to a vast, emerging economy and a profoundly changing society. Propelled by individual aspirations and a common poverty, as many as 100 million peasants have poured out of the country's poor hinterland to look for work in newly

prosperous cities and coastal regions. They are taking jobs on construction sites, in factories and restaurants, usually under grueling conditions and for low pay.

The Great Migration

Much like the population shifts that fueled the development of industrial centers such as Chicago and Detroit in the U.S. in the 1940s and '50s, China's great migration is helping spur the country's double-digit growth and narrowing the wealth gap between city and countryside. But for Ms. Hong, the trip also represents a personal odyssey of sorts, a search for independence and maturity amid hardship and misadventure.

The rain is falling in sheets, trickling down the side of the bus windows and through the cracks into Ms. Hong's lap. Outside, the lush, green hills of her Xiaba village have long disappeared, replaced by the craggy, barren mountains of Guizhou province. Mud huts perch along winding roads, awash with slick red mud.

handout #1

Children dressed in dirty rags sit in doorways, staring at the occasional truck rumbling by. Ms. Hong groans and tries to stretch her long legs. Crammed beside her, her best friends Zhou Yong and Jiang Hong reluctantly readjust themselves in the narrow seat to accommodate her movements.

Ms. Hong recalls leaning out the window as the bus first sputtered to life and watching her village, a handful of sorry wooden houses perched near the source of the Yangtze River, fade into the distance. But now, Xiaba seems thousands of miles away, and it feels like they have been riding on the bus forever.

The hardest part is the motion sickness. Ms. Hong isn't used to the bouncing of the rickety bus: she seldom took buses for any distance at home. Lei Rongfu, a kindly, permanently exhausted labor official who is overseeing their trip, hands out antinausea pills, but the medicine doesn't help much. The only thing Ms. Hong manages to keep down is some sugar cane, packed by her mother with bags of oranges, salted duck eggs, peanuts and bottles of orange soda. Every few hours she and her friends take turns vomiting out the bus window.

Obstacle Course

Bathrooms are another problem. In the Chinese countryside, toilets are a shed with two or three holes

in the ground or sometimes simply a private spot behind the road. With 100 women all vying to go at once, the wait is long and the stench overwhelming. At one stop, Ms. Hong makes a desperate dash for the men's bathroom, as other women resort to the ground outside.

Then there are the endless delays. The first evening, the bus is pulled over at 4 a.m. by a drunken traffic-checkpoint official. The second night, the drivers stop for a tire change. Later that same evening, a coal truck gets stuck in the mud a mile down the road from them and the bus stewes all night and well into the next morning amid a convoy of pig-filled trucks, clanking tractors and packed buses. The following night, they hit another traffic jam and require another tire change. On the fourth day, it's that tire again.

Meanwhile, the bus begins to reek of stale sweat, vomit and rotting food. Damp washcloths hang from the luggage racks, and garbage and mud cover the floor. No one dares open a window, except to throw up, on account of the rain and the mountain chill. Sometimes it's hard to breathe. "Who thought it would be so hard?" Ms. Hong asks. "I really miss my family."

Brushing the bangs from her face, she flips through a small photo album. There are pictures of her parents, her older brother and sister,

and herself, young and pretty with generous, emotional features. Snapshots of her boyfriend evoke numerous sighs. As homesick as she feels, though, Ms. Hong doesn't regret leaving; ever since she can remember, she has always itched to get away.

It wasn't just the poverty, as with some of the others. Miss Zhou's family, for example, had to scrape and borrow to come up with the 415 yuan, about \$50, in fees and transport costs for the trip, and she is hoping to ease her parents' financial burdens with her salary at the Mattel factory. Ms. Hong's family could also use the money, even with their one-room general store and their harvests of oil-bearing rape crops.

The Poison Sellers

More important, Ms. Hong was bored—bored with high school, which she quit her first year because she felt it wasn't teaching her anything useful; bored with the long hours tending her parents' shop, with no other job options in sight; bored especially with the cries of the village vendors selling rat poison next to piles of huge dead rats. "Life in the village is empty," she says. "I want to be independent. I want to learn something so I can come back and change my home." With the money she earns at Mattel, she muses, she could open a business back home, "maybe a clothes shop or a general store."

Amid the hardships, Ms. Hong finds an opportunity to cement old friendships and strike up new ones. "I've met a lot of new friends," says Ms. Hong, as she passes around eggs and fruit to her neighbors. "I feel like I've become more mature, having to take care of myself."

As the bus slowly winds its way south, the air turns hot and humid. On the fifth afternoon, after Ms. Hong has fallen into a state somewhere between apathy and despair, Guangdong finally lurches into view. Shiny new houses rise out of the paddy fields, and boats drift languidly through the wide, muddy waters of the Pearl River. Ms. Hong shakes off her stupor to marvel at the skyline bristling with high-rises, the cacophonous snarl of traffic, the bustle of the provincial capital, Guangzhou.

But Changan, another hour's drive away and only 60 kilometers from the British colony of Hong Kong, doesn't seem half so grand to her. During the past few years, economic reforms have transformed the sleepy farming village into a booming, but dreary, migrant town. Factories belch smoke into the air, and bleak, identical-looking dormitories house the 150,000 migrant laborers who have flocked to work here, swelling the original local population of 31,000. At all hours, workers swarm the narrow streets in pairs of small groups,

getting off the day shift, heading to work the night shift, or in search of food or fun.

Mattel's factory is in the middle of town, a modern white building with iron gates. The factory, which churns out Barbie dolls and accessories around the clock for local sale and export, is commonly known here as "Paradise of Girls," because most of its 3,500 workers are women. As Ms. Hong shuffles exhaustedly off the bus with her two ragged bags, nothing looks closer to paradise than the factory, where she can look forward to her first shower in five days and sleep in a real bunk bed.

But there isn't much opportunity for rest. The first day after Ms. Hong's arrival comprises a dizzying round of paperwork, lectures and medical checkups, and the beginning of training. After listening to a strict speech on factory rules—miss one day of work, lose three yuan from your salary; miss three days in a row, you're fired—she signs a contract committing herself to working three years at Mattel.

Privately, she hedges: "I'm going home for my 20th birthday, and I'll see whether I want to come back after that."

Amid all the bustle of settling in, Ms. Hong snatches a moment to write a short letter home, assuring her parents that she arrived safely. In the evening, after a four-hour training session

and dinner in the factory canteen, she sneaks out with Ms. Zhou and Ms. Jiang to visit a friend working at another factory. The excitement of her new life momentarily takes the edge off her exhaustion and homesickness. "It's a lot more lively here, and everything is interesting," she enthuses, taking in the bright lights and bustle of Changan under a fine drizzle.

But the novelty starts to wear off, and reality sets in.

A cold, heavy rain is falling late one afternoon when Ms. Hong bursts into her dorm room with Ms. Zhou and collapses breathless on her bed. "Oh, my aching hands," she wails. Ms. Zhou shows off a purple spot on her finger. "Look at this bruise," she moans, painfully untying her shoelaces with stiff, swollen fingers. The two have just finished their second full day of training, learning to punch rows of fine holes in plastic Barbie-doll heads and weave in strands of blonde or brown hair.

"If you don't clamp the heads at the right angle in the machine," Ms. Hong explains with a giggle, "they go flying all over." But she adds proudly that her supervisor has already singled her out for praise, commenting on her fast mastery of the task.

Paltry Pay

Ms. Hong begins to adjust to other aspects of

handout #1

her new life, although little meets her expectations. She and 11 other women live crammed into a narrow room with a concrete floor, a fluorescent bulb and a bathroom barely big enough to turn around in. Cold water sputters on for a few hours twice a day, while the meat served in the canteen is too tough to swallow and has hair on it.

The pay, it turns out, is paltry, only 200 yuan a month, or about \$24, during the first three months—the Sichuan labor officials had promised 350 yuan, Ms. Hong says—and the hours are long. “They say we’ll be able to make 500 yuan,” she says with a snort. She has asked around and the 500-yuan figure seems to be fiction. “People earn 400

yuan at most,” she says. “That’s too low. When you come out, you should be able to earn real money—or just stay at home.”

Mattel officials declined to comment on salaries or provide access to the Changan factory, saying they didn’t want to spark misconceptions about working conditions. But Glen Bozarth, a spokesman, says, “We’re confident that we provide these workers with a better standard of living than they would have without Mattel.”

There are other lessons for Ms. Hong, among them learning to live without her parents and making it on her own. Strolling in the Changan streets one night after work, she stops in front of a shop window.

She stares at heavy, shining gold chains and delicate necklaces, then moves on. “I won’t get paid for another month and I’ve only got 50 yuan left,” she says. “I could ask my parents for money, but my conscience tells me not to.”

Despite the loneliness, the low pay and the struggles of her new life, Ms. Hong doesn’t regret grasping the opportunity.

“I can’t become independent unless I earn my own money and learn to survive on my own,” she says. If she had stayed in the safety of her village, she says, she would be “like a flower in a greenhouse. It can’t feel the wind blow and can’t grow stronger.”

BOOMTOWN DISCUSSION CARDS

Card 1—Economic Goals

You are a labor official in Guangdong province in charge of recruiting young workers from Sichuan province to work in the new Mattel factory. You traveled on the bus with Xiaohui and her friends to find out what their economic situation was before they made the journey and how they hope to change it by working in Changan. Discuss what Xiaohui and her friends' economic goals are for their new life.

Card 2—Personal Goals

You are a passenger traveling on the bus to Changan sitting behind Xiaohui's seat. You have talked with her very often during the journey. Most of your discussions have been about her personal life and her hopes and dreams for her new life in the Mattel factory. Aside from her monetary reasons for going on the trip, what other reasons did she give you for leaving Sichuan?

Card 3—Living Conditions

You are the bus driver. You have traveled this road between Sichuan and Guangdong more times than you can remember. You are bored, and your mind soon wanders to thinking about how the people live along your route and the differences you see between people in Changan and in the countryside you just left. What might you see on your journey that would give you a clue to how these people live? What are their daily living conditions?

Card 4—Who Benefits?

You are a local politician in Xiaohui's village. Your daughter wants to leave the next time the labor officials come back to your village. You are concerned about the recruiters and who may be behind them, so you start asking who really benefits by having these workers move out to Changan. Aside from the workers, who else might benefit from this migration movement? Try to think of answers that are not so obvious too.

cards

Card 5—Toy Factory Site

You are a U.S. toy factory executive who wants to open up a factory in China. You sent a research team to both Sichuan and Guangdong provinces to find a suitable location for your factory. Their report is now on your desk. What information do you think the research team had to look at before recommending a site? Which province did they choose and why?

Card 6—Locating a Business

You are the owner of a business located in the same small town as your residence, and are thinking of moving your business to a larger city. Think about Xiaohui's village and Changan. How can they help you decide whether you will place your business in a large city or a small town? Consider similarities and differences.

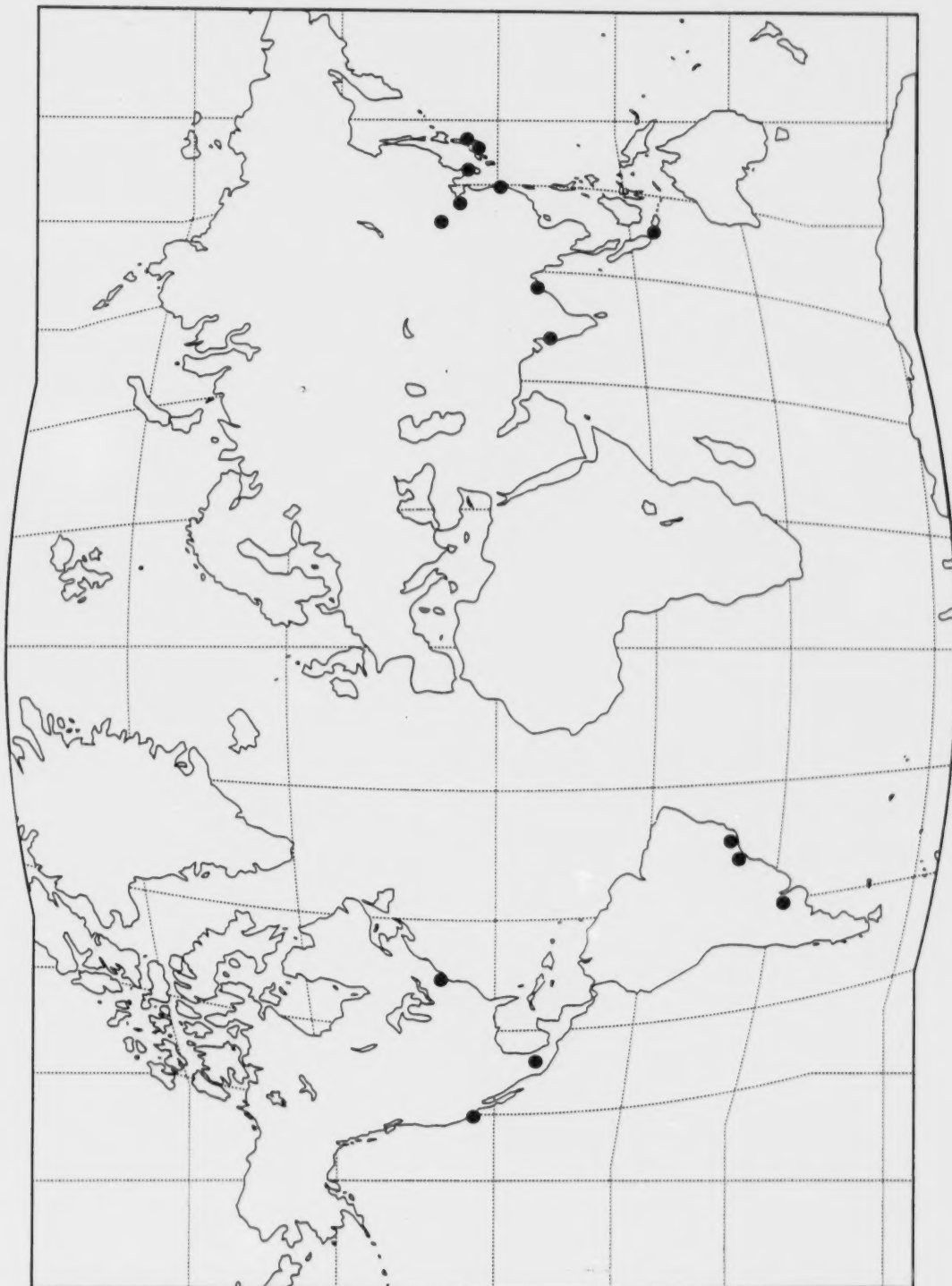
BOOMTOWN CLASS DISCUSSION SUMMARY

Economic Goals	Personal Goals	Living Conditions
Who Benefits?	Toy Factory Site	Locating a Business

WORLD MAP



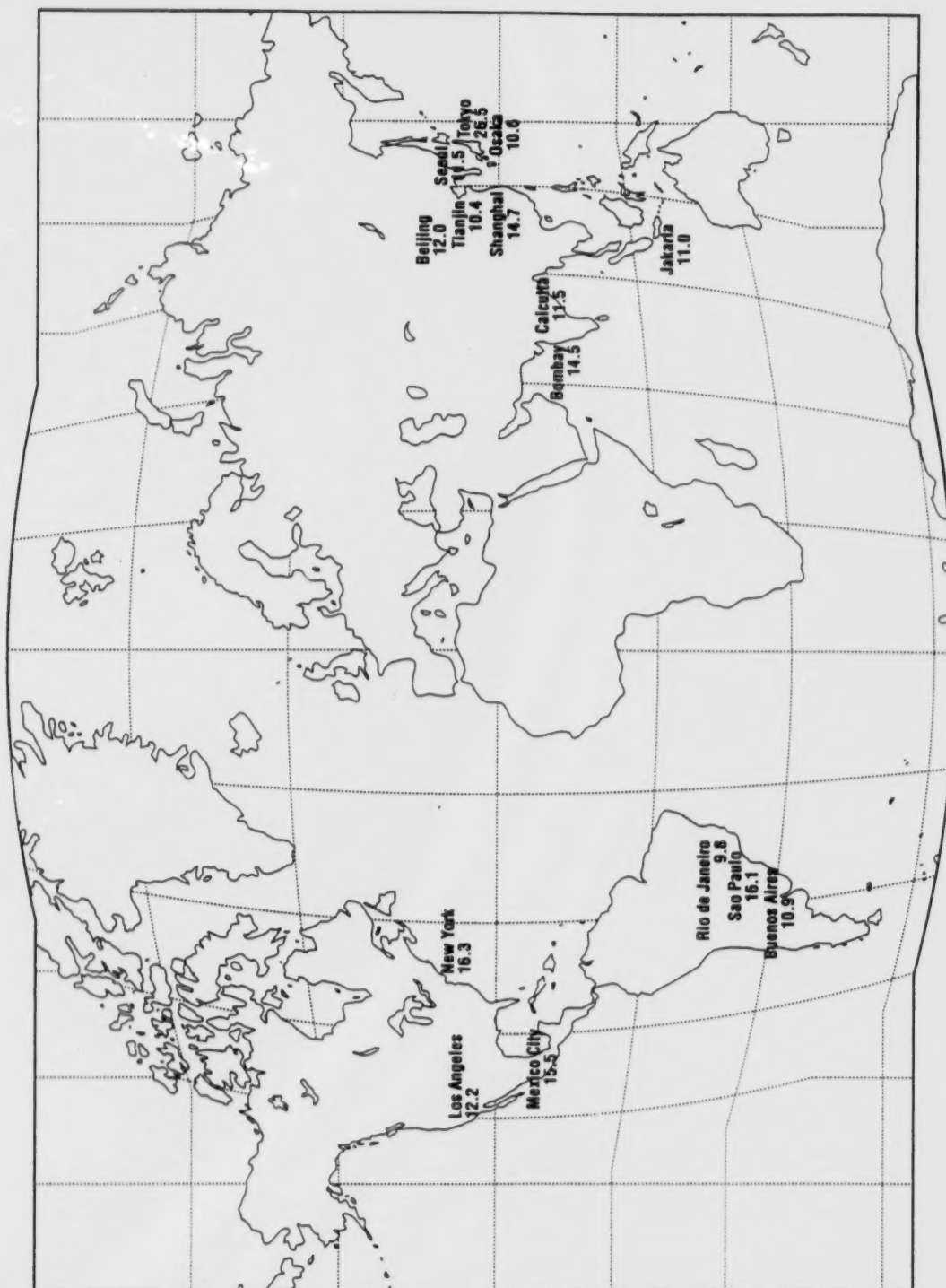
**MEGACITIES OF THE WORLD, 1994
(WITHOUT MEGACITY NAMES)**



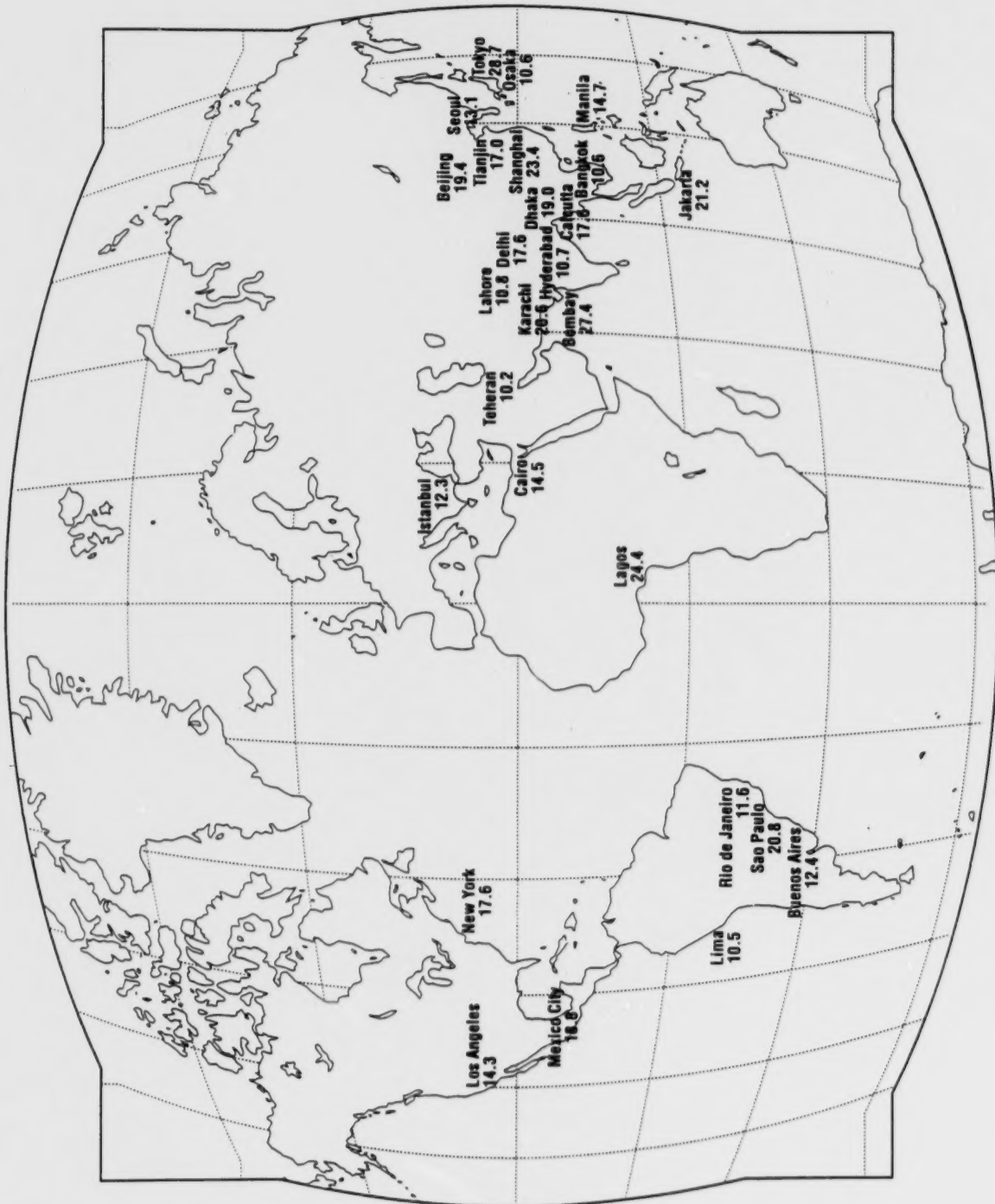
MEGACITIES IN THE ASIA/PACIFIC REGION

21

**MEGACITIES OF THE WORLD, 1994
(WITH MEGACITY NAMES)**



PROJECTED MEGACITIES OF THE WORLD, 2015



transparency

TOP TEN MOST POPULATED MEGACITIES OF THE WORLD, 1994 AND 2015

Cities (Countries)	1994 Populations (Rank)	2015 Projected Populations (Rank)
Dhaka (Bangladesh)		19,000,000 (9)
Sao Paulo (Brazil)	16,110,000 (3)	20,800,000 (6)
Beijing (China)	12,030,000 (8)	19,400,000 (8)
Shanghai (China)	14,709,000 (5)	23,400,000 (4)
Bombay (renamed Mumbai in 1996) (India)	14,496,000 (6)	27,400,000 (2)
Calcutta (India)	11,485,000 (9)	
Jakarta (Indonesia)		21,200,000 (5)
Tokyo (Japan)	26,518,000 (1)	28,700,000 (1)
Mexico City (Mexico)	15,525,000 (4)	18,800,000 (10)
Lagos (Nigeria)		24,400,000 (3)
Karachi (Pakistan)		20,600,000 (7)
Seoul (South Korea)	11,451,000 (10)	
Los Angeles (United States)	12,232,000 (7)	
New York City (United States)	16,271,000 (2)	

Source: *World Urbanization Prospects: The 1994 Revision*. New York: United Nations, Population Division, 1995.

group project handout #1

KENJI: WHAT HAPPENED TO THE FISH?

Kenji looked at his fishing pole lying in the corner of his room. His junior high school had just started its six-week summer vacation. He could hear the rhythmic buzz of the insects through the open window, and he could feel the hot and humid air all around him. Although he still went out almost every day to practice baseball with his school team, the break from classes usually gave him some free time to visit with his grandfather and do some fishing in the lakes and streams near Nagasaki, a major Japanese city on the southwestern Japanese island of Kyushu.

This summer, though, would be different from the others. Kenji had just come back from his grandfather's house. He had listened sadly as his grandfather told him that the fishing wasn't that good anymore. For some reason, there were increasingly fewer fish from year to year, and word was out that there wasn't much reason to even try to catch any this year. Kenji got up and walked across the straw mats that made up the floor of his room. He took one last look at his pole, slid open the wood-and-paper door, and made his way to the living room.

Kenji found his father working on some papers from the chemical company that employed him. He was sitting cross-legged on the floor in front of the low square table in the center of the living room. He looked up as Kenji entered the room.

"Dad, do you know why there aren't any fish in the lakes and streams near Grandpa's house anymore?"

His father pushed up his reading glasses and thought about how to answer his son's question. "Well, my friend at work says that the same thing that's killing the fish is making me bald." His father cracked a smile and massaged the top of his smooth scalp.

Kenji gave a quick chuckle. "Father ... I really want to know."

"Okay, Kenji, my friend at work says that a group of scientists came up with a model of something that might answer your question. Do you know what a model is?"

"Isn't it somebody's guess about how something works?"

"That's right. The model the scientists came up with takes weather patterns and sources of pollution, puts them into a computer, and tries to predict what's actually happening to certain areas of Asia. I'm a little busy with work this week, but if I get some information, could you make it a summer project to see if you can figure it out yourself?"

"Thanks, Dad. I'll try my best."

Group Project

Part 1: In your group, look over the material on "Air Pollution," "Beijing and Tokyo Air Pollution Graphs," and "Sulfur Deposition Map" that Kenji's father brought home the following day. Use your graph reading ability to look at the differences in pollution emissions between Beijing and Tokyo. Also, read the information on air pollution and use the sulfur deposition map and see if you can see any patterns that might help you to understand why the fish are dying around Nagasaki, Japan. Be prepared to support your idea in a class discussion. A good framework for your research might be to look for common pollutants, their sources, their effects, and their prevention.

Part 2: Kenji decided to write a one-page paper about his summer project and make a poster he could show his homeroom class when he returns from summer vacation. In your group, write a one-page paper explaining what you think killed the fish, and prepare a poster with drawings that warn your class about the source and effect of the problem. Also, illustrate possible solutions.

group project handout #2

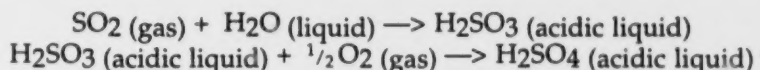
AIR POLLUTION

Urban air pollution is a serious problem for Asia. The three main pollutants usually cited in air pollution publications are greenhouse gases, small bits of carbon and heavy metals also known as particulates, and chemicals containing sulfur and nitrogen. World Health Organization data show that of the top fifteen cities in particulate matter and sulfur dioxide emission, Asia has twelve of the worst in particulate matter and six of the worst in sulfur dioxide. Of the top seven cities to receive the worst overall ranking, Asia has five: Beijing, China; Calcutta, India; Jakarta, Indonesia; New Delhi, India; and Shenyang, China (Brandon, *Toward an Environmental Strategy for Asia*, 1993, p. 49).

Asian production of greenhouse gases made up 20 percent of the worldwide total in 1985. These greenhouse gases are a mix of gases that include carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). China was the largest emitter, producing 540 million tons of carbon dioxide (from human activity). Sources included rice fields, rural residential cooking and heating, and livestock (Brandon, p. 93). Greenhouse gases trap heat in the earth's atmosphere, leading to a rise in global temperatures.

Burning fossil fuels in cars, factories, and homes produces airborne particulates. These particulates are usually made up of small bits of carbon but can also contain small bits of heavy metals (Brandon, p. 94). These particles are small enough for a person to breathe. In the lungs, they can cause lung cancer and other respiratory diseases. Lung cancer mortality is four to seven times higher in Chinese cities than in the world as a whole. In Calcutta, 60 percent of the population suffers from respiratory diseases (Brandon, p. 51). Decreased lung function was reported for Chinese women using coal stoves (Brandon, p. 96).

Nitrogen and sulfur oxides also result from the burning of fossil fuels. Sulfur dioxide is a major problem in Asia, which sent 35 million tons into the atmosphere in 1990 (Brandon, p. 23). China produced more than half of the emissions of sulfur dioxide. Most of these emissions came from the burning of high-sulfur coal in power plants, factories, and homes. When sulfur dioxide (SO₂) goes up in the atmosphere, it combines with water (H₂O) to form sulfurous acid (H₂SO₃). This sulfurous acid combines with oxygen (O₂) to form sulfuric acid (H₂SO₄). Here is the formal process:



When the sulfuric acid falls to earth, it is called acid rain.

Acid rain reacts with marble (calcium carbonate) and results in the destruction of monuments and statues. It also causes damage to animal life and food crops and can destroy forests. Limestone scrubbing technology can remove the sulfur dioxide before it is released to the atmosphere. However, the technology is very expensive and can amount to 30 percent of the cost of a modern power plant and up to 20 percent of the annual maintenance costs. Cleaning the coal at the coal mine to reduce its sulfur content is another way to prevent the eventual release of sulfur dioxide. This cleaning process has the added benefit of reducing the weight of the coal, thereby lowering transport costs.

Source: Brandon, Carter; and Ramankutty, Ramesh. *Toward an Environmental Strategy for Asia*. Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank, 1993.

group project handout #3

BEIJING AND TOKYO AIR POLLUTION GRAPHS

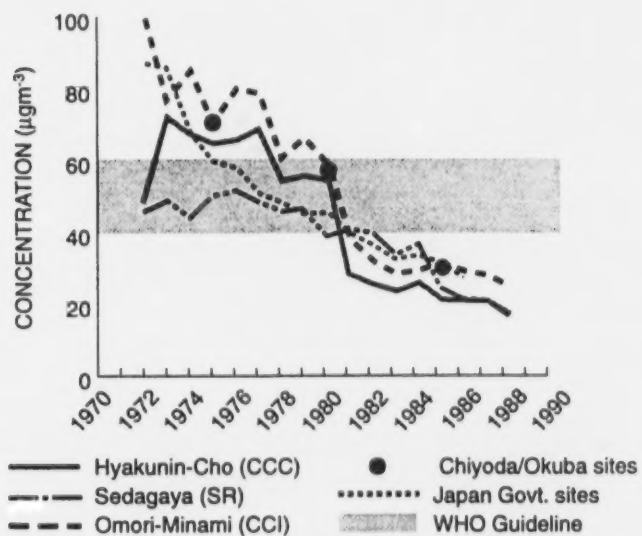
Analyze the two graphs for the megacities Beijing and Tokyo on the next page. They show the sulfur dioxide emissions for the two cities up to 1990. Beijing and Tokyo are the capitals of their countries and are major industrial centers. Looking at pollution patterns in the two megacities, one can gain an understanding of what may be happening in the two countries as a whole. The data come from different parts of each city so SI refers to a suburban industrial part, SR refers to a suburban residential part, CCC refers to a city center commercial part, CCI refers to a city center industrial part, and CCR refers to a city center residential part. Try not to be confused by all the different city parts. Try to follow the line for each megacity that represents the city center commercial (CCC) part and compare only these lines. The "WHO guidelines" are recommended by the World Health Organization as levels that a city should not exceed. (Graph source: World Health Organization, *Urban Air Pollution in Megacities of the World*, 1992, pp. 59, 214)

Guidance Questions:

1. Which city produces the highest levels of sulfur dioxide?
2. Which city shows a drastic reduction in sulfur dioxide levels?
3. If the technology exists to prevent the release of sulfur dioxide, why might one country be able to use the technology while another can't

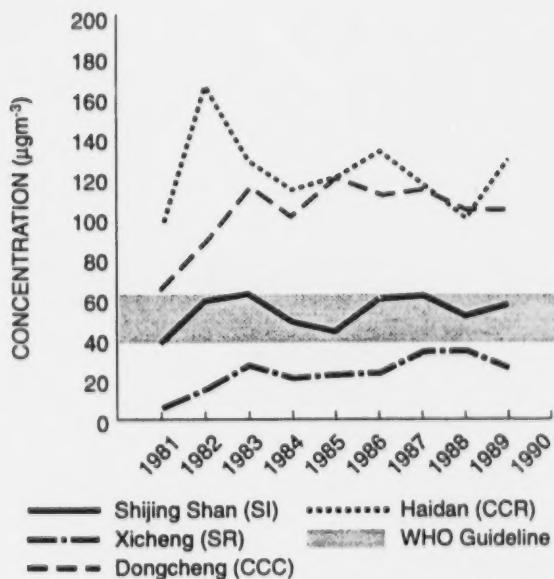
group project handout #3

Tokyo:



Source: GEMS data; Government of Japan, 1988;
Komeiji et al., 1990

Beijing:



Source: GEMS data

Graphs reprinted with permission from: World Health Organization. *Urban Air Pollution in Megacities of the World*. Oxford: Blackwell Publishers, 1992, pp. 59 and 214.

ENERGY AND SOCIETY

Organizing Questions

- What are characteristics of energy use in the megacities of Beijing, Mumbai (formerly Bombay), and Manila?
- How does energy use affect society and personal lifestyles?
- What are characteristics of high- and low-energy use societies?

Introduction

"Man's cultural and social development, his distinction and alienation from the other animals, have been made possible by his exploiting energy sources outside his own body. ... It is a paradox that, despite our marvelous ability to find and use energy, to measure it, and to predict its state, we are very far from being able to forecast accurately the social impacts. ... We understand energy scientifically, we control it technologically, but we have not mastered it as the major factor of social well-being." (Cook, *Man, Energy, Society*, pp. 1-2)

This lesson consists of three parts. Part 1 has students divide into groups to explore energy use in the megacities of Beijing, Mumbai, and Manila. Students read about the historical background of these cities and people's lives in relation to energy. They then brainstorm the societal implications of each city's energy use using a worksheet.

In part 2, students continue their exploration of a megacity by preparing brief overviews of the city and presenting them to the class.

In part 3, students brainstorm and identify elements of a sociological theory about energy use that distinguishes between high- and low-energy use societies. Students relate what they have learned about high- and low-energy societies to similar behavior and values that can be found in their own lives.

Objectives

knowledge

- to understand the spectrum of energy use around the world
- to learn the implications energy choices have on personal and societal behaviors
- to recognize one way in which sociologists analyze energy use and its effects on society

lesson two

attitude

- to understand and critically analyze the different effects of energy
- to approach the study of energy from a sociological perspective
- to recognize cross-cultural similarities in energy use
- to work collectively in groups

skill

- to summarize and present information in logical, clear ways
- to see connections and similarities among different cultures
- to formulate ideas into broad theories about energy use
- to extend knowledge to one's own personal life

Materials

- World Energy Map, color transparency (included with curriculum unit)
- Discussion Points for World Energy Map, for the teacher
- Handout #1, Beijing: Living with Coal, one or two copies
- Handout #2, Mumbai: Nuclear Problems, one or two copies
- Handout #3, Manila: Geothermal Options, one or two copies
- Handout #4, Thinking It Through, one per group of four–five students
- Handout #5, An Energy Theory, one per group of four–five students
- Summary Chart, transparency
- 6–9 sheets of poster-size paper
- Color markers
- Tape

Procedure— Part 1



1. Begin this lesson by showing students the World Energy Map color transparency, using an overhead projector. Ask students to offer their various interpretations of which countries use the most energy, which use the least, and which are in the middle range. Refer to Discussion Points for World Energy Map as a guide for this activity.



2. Divide students into three or six groups of four or five people. Distribute one copy of Handout #1, Beijing: Living with Coal; Handout #2, Mumbai: Nuclear Problems; or Handout #3, Manila: Geothermal Options, to each group. Pass out copies of Handout #4, Thinking It Through, to every group.

lesson two

3. Explain to students that they will be working on a group activity regarding energy use in a megacity. Make it clear to students that although there are other energy options for people living in these megacities, the students will focus on just one in their group activities.
4. After reading their handouts, students will use Handout #4, Thinking It Through, to summarize key points about their megacity. The purpose of this activity is for students to organize information for their presentation and to brainstorm possible cultural values implicit in energy use.

Procedure— Part 2

1. Distribute two–three sheets of poster paper and several markers to each group.
2. Explain to students that they will be preparing group presentations about the megacity they studied, and will present the information collected on Handout #4, Thinking It Through. Tell them to refer to the "Presentation Pointers" on their handout as they prepare their presentations on the poster paper.
3. Have students tape their poster paper in an area visible to the entire class. Each group should present their megacity for approximately 10 minutes.
4. Have students leave their poster paper up for the next activity.

Procedure— Part 3

1. Tell students that they will synthesize the information gathered from the period before, and try to formulate a "theory" about energy use from similarities and patterns found among the three megacities.
2. Clarify that although students studied only three megacities, they can nevertheless brainstorm broad connections between the megacities' industries, energy needs, and lifestyles of the different affected groups.



3. Using the Summary Chart transparency, encourage students to offer their ideas freely. Remind them to refer back to the poster paper from the day before and to their worksheets. This brainstorming activity should be loose and informal. The Summary Chart can be duplicated in larger form on the blackboard if more space is needed to write students' ideas.
4. Once the chart has been developed, pass out Handout #5, An Energy Theory. Stress that this is just one approach to studying energy use and that it describes societies at the extremes of an energy use continuum (along which the types of energy used, the ways in which energy is used, and people's lifestyles differ).
5. Allow students to read the handout. Afterwards, engage them in a discussion on whether they agree with the theory. Why or why not? Can they recognize any characteristics of their own communities in this theory? In what ways?

Lesson two

Enrichment Activities

Activity #1

- Students use the section "Personal Reflections" on Handout #5, An Energy Theory, to write essays on how their personal use of energy affects values, work activities, or family patterns in their lives. Students could also write about where they see themselves on the continuum of energy use.

Activity #2

- Students engage in a debate over the theory of high- and low-energy societies, citing the problems with such an approach as well as the benefits.

Activity #3

- Students research other sociological theories about energy use and prepare brief presentations or reports about them.

Activity #4

- Students discuss this quote: "There is probably no country that does not use its energy system as a tool to achieve social goals" (Fesharaki et al., *Pacific Energy Outlook: Strategies and Policy Imperatives to 2010*, p. 282). Do they agree or disagree? Can they support their opinions with examples?

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for the teacher

DISCUSSION POINTS FOR WORLD ENERGY MAP

1. Which areas in general have the highest energy use?

North America
Australia
Northern Europe

2. Which areas in general have the lowest energy use?

Northern areas of South America
Most of Africa
East Asia and Pacific
South Asia

3. Which countries use the most energy? (shown in purple)

Australia	Norway
Canada	Sweden
Finland	United Arab Emirates
Iceland	United States

4. Which countries use the least energy? (shown in red and orange)

Angola	Ethiopia	Mauritania	Somalia
Bolivia	Honduras	Nigeria	Sudan
Brazil	India	Pakistan	Tanzania
Cambodia	Indonesia	Paraguay	Thailand
China	Kenya	Peru	Zaire
Columbia	Mali	Philippines	

5. Which countries fall within the mid-range of energy use? (shown in green and yellow)

Argentina	Iraq	North Korea	South Africa
Brunei	Malaysia	Poland	South Korea
Bulgaria	Mexico	Portugal	Spain
Greece	Mongolia	Romania	Venevuela
Iran	New Zealand	Russia	

NOTE: Explain to students that this map represents international use of commercial energy sources (gas, coal, nuclear power, etc.). It does not reflect use of traditional fuels, such as biomass (wood, animal dung, vegetable waste, etc.).

BEIJING: LIVING WITH COAL

This handout concentrates on the use of coal in Beijing. Although other forms of energy are available in Beijing and throughout China, we will focus our discussion on one source. Use the glossary at the end of this handout to look up definitions of words.

Beijing is the political, administrative, and cultural center of China. This megacity began as a small town during the Han dynasty over 2,000 years ago. The Mongol leader Kublai Khan first established Beijing as the political center of his empire in 1294 AD. Except for brief periods, Beijing has remained China's capital ever since.

City Profile

The name Beijing means "northern capital." With a population of 12 million, it is the second largest city in China after Shanghai. Beijing's major industries include the manufacturing of iron, steel, machinery and agricultural equipment, electronics, and petrochemicals, and food processing.

Beijing is an unusual megacity because agriculture contributes a large amount to its economy. This stems partly from the socialist belief that cities should produce, as well as consume, and Beijing has striven to become self-sufficient in its food production. Since 1949, Beijing's industrial and manufacturing sectors have also grown rapidly.

Coal supplies most of Beijing's energy needs, and three-quarters of China's energy needs in general. As the world's leading producer and consumer of coal,¹ China will continue to rely on coal for some time to come. However, researchers predict China's use of coal as a primary energy source will gradually decrease from 75 percent at present to 63 percent in 2010.²

Urban Energy Use and Lifestyle

Seven million of Beijing's residents live in the city proper, while the remaining live in surrounding areas. Although oil, hydroelectricity, and natural gas are available, urban residents rely on coal for most of their household needs. With the flip of a switch or the light of a match, city residents can cook their food, heat their homes, and fulfill all other household needs conveniently. They do not have to spend time collecting their fuel, as rural residents of Beijing do. With the city's modern conveniences, skyscrapers, international restaurants, and shopping malls, urban residents lead a different lifestyle from those in the outlying areas.

As a result of capitalist reforms during the 1980s and '90s, Beijing's urban residents have moved away from some of the socialist values of hard-working peasants living off the land. China's growing middle class has adopted many capitalist values and Western ways. In this transformation, Beijing's energy use has followed the trend of most developing countries, which has been to use less biomass fuels and more commercial-energy fuels.

The shift to commercial fuels is also due to energy-intensive industries and transportation, which require more energy than biomass fuels can supply. Modern appliances in the Chinese home (although scarce), such as refrigerators and air conditioning, also require large amounts of energy.

¹ Fesharaki et al., *Pacific Energy Outlook: Strategies and Policy Imperatives to 2010*, p. 5.

² *Ibid.*, p. 8.

handout #1

Although Beijing urban residents suffer from frequent household energy shortages, they nevertheless are able to spend more time engaging in other activities, without having to worry about where their food or energy resources will come from. No longer do they rely on the family to provide for basic necessities, as in the countryside. Instead, a variety of goods and services are provided for them by outside sources and are purchased, rather than made, by the people.

Rural Energy Use and Lifestyle

Three million of Beijing's residents live in an agricultural zone that surrounds the city and supplies grain and vegetables for its urban residents. About 40 percent of Beijing's population engages in agriculture to some extent, since China is traditionally an agrarian society. Although the country is experiencing a period of intense urbanization and development, agrarian families still represent a large portion of society.

Rural residents, though not necessarily poor (some earn more than city workers), must nevertheless supply their own wood, dried dung, and vegetable waste to satisfy basic household needs, for no gas or electricity is available in some rural areas. The modern appliances more readily available in urban Beijing can be nonexistent in the countryside. Fewer than 10 percent of Chinese families nationwide have a refrigerator, and about the same number use old-fashioned stoves for cooking and heating.³

Rural families need fuel to cook meals, boil drinking water, prepare food for livestock, and heat their homes in Beijing's cold climate. They must therefore spend a part of their day collecting these energy sources. This takes time away from other activities, such as entertainment or education. In areas where fuel sources are scarce, more time is needed to find them. Four-fifths of China's population still depends on fuels supplied by themselves, while the modern energy fuels are reserved for cities such as Beijing.⁴

Unfortunately, the collection of wood for fuel has led to the deforestation of much of China's countryside. China is trying to make coal more accessible to rural areas,⁵ partly by making it cheaper for rural residents to buy. As coal becomes more commonly used in rural China, the lifestyles of agrarian families will change in response to the availability of this fuel.

Think about it. How does the availability of coal affect the lifestyles of Beijing's urban residents differently from the lifestyles of rural residents?

³ Debeir et al., *In the Servitude of Power*, p. 232.

⁴ Smil, *Energy in China's Modernization: Advances and Limitations*, p. 41.

⁵ Smith, "A Dangerous Trade: Saving Wood by Burning Coal," p. 2.

How Coal Works

Coal comes from tree and other plant materials that have decomposed in the ground over millions of years. Coal is then mined and transported to cities or power plants. When burned, coal provides heat to generate electricity, power machines, cook food, heat homes, etc.

In the future, clean coal technologies will be adopted by developing countries. These technologies improve the efficiency of coal burning and reduce damage to the environment. China is notorious for burning coal inefficiently, and is responsible for two-thirds of all sulfur oxide emissions in the Asia/Pacific region. (Sulfur oxides deplete the upper atmosphere's protective ozone layer.). The country is expected to adopt cleaner coal technologies gradually, becoming a major user of them in Asia by 2010.⁶

Glossary

agrarian	related to farmers or farming
biomass	plant material and animal waste used for fuel
commercial energy	energy that is not supplied by individuals but must be bought from the government or private companies
Han dynasty	ancient Chinese dynasty dating from 207 BC to 220 AD
hydroelectricity	electricity produced by waterpower
Kublai Khan	founder of the Mongol dynasty in China
Shanghai	largest city in China, lies on the eastern coast of the country
socialist	referring to a system of society in which there is no private property

⁶ Fesharaki et al., *Pacific Energy Outlook: Strategies and Policy Imperatives to 2010*, pp. 68–69.

handout #2

MUMBAI: NUCLEAR PROBLEMS

This handout concentrates on the use of nuclear power in Mumbai. Although other forms of energy are available in Mumbai and throughout India, we will focus our discussion on one source. Use the glossary at the end of this handout to look up definitions of words.

Previously known as Bombay, Mumbai was renamed in 1996 to honor the Hindu goddess Mumba. This megacity lies on the western coast of India, and was originally a collection of seven islands. In the 1800s, landfill ventures joined all the islands into a single landmass. Mumbai is now an island, connected to India's mainland by bridges.

In the 1600s, Bombay developed into the economic capital of India because of its port. Travelers originally came to India by boat and Bombay was their "gateway" into the country. The British attracted settlers from across the country with promises of religious freedom and land grants, which helped develop a diverse society in Bombay that has continued to this day.

City Profile

Mumbai handles half of India's foreign trade and is home to its largest stock market. The city is the industrial capital of the country, manufacturing everything from textiles to pharmaceuticals. Mumbai also churns out almost 300 movies a year—it is known as the Hollywood of India.

With opportunities for fame and fortune, the city has always attracted the poor. Unfortunately, continuous migration from rural areas has created some of the worst slums and overcrowded conditions in Asia. Because it is an island, there is nowhere for Mumbai to expand to accommodate its growing population, currently at 16 million people. Consequently, a "new" city of Mumbai is under construction on mainland India.¹

Nuclear Power in India

Although most of Mumbai's power is supplied by coal, oil, and natural gas, nuclear reactors provide some of the city's energy needs. Growth of nuclear power plants is thriving in Asia, unlike other areas of the world. This phenomenon stems from the fact that many Asian countries would like to be self-sufficient in their energy resources (and not have to import them) to meet the increasing demand for more energy in Asia.²

India sees nuclear power as being a critical supplier of energy in the future, since coal (the most common energy source used in India) cannot be easily transported and is plentiful only in certain areas of the country.³

Unfortunately, India's nuclear reactors are some of the most inefficient in the world. It is not unusual for them to be out of operation for half of the year.⁴ One example is the nuclear plant in Tarapur, located to the north of Mumbai. To handle energy demands, India built this nuclear plant in the 1970s, the first of its kind in the country. Since then, inefficiency, maintenance, and radiation problems have continually plagued Tarapur. Judged by the

¹ Finlay, *India*, p. 772.

² Hagen, "Nuclear Energy Thrives in Asia," p. 2.

³ Thomas and Ramberg, *Energy and Security in the Industrializing World*, p. 23.

⁴ Arnett, "India's Nuclear Brownout," URL:
<http://www.sipri.se/projects/technology/Bull.html>

amounts of electricity generated by its plants, India's nuclear power program overall has been a failure.⁵

Unfortunately, this means less electricity for Mumbai's residents, who suffer serious energy crises and power failures on a regular basis. A 1991 government study reported that India would have to triple its energy capacity by 2007,⁶ which would be the case especially for Mumbai.

Urban Energy Use and Lifestyle

As a result of Mumbai's economic boom, more and more companies have settled in the city. Incoming business and tourism have led Mumbai to develop modern conveniences, skyscrapers, and shopping centers to support and enhance its economy. The city's prosperity has created wealthier middle and upper classes and widened the gap between rich and poor.

With access to energy sources and the ability to pay for them, wealthy residents can cook food, heat homes, and fulfill other household needs more easily than those living in the city's slums. Although these slums vary greatly in how developed they are (some slums have many modern conveniences),⁷ Mumbai's middle and upper classes still experience a higher standard of living.

Businesses and wealthier citizens use most of Mumbai's energy. While industries enjoy most of the benefits of new energy developments, including the building of nuclear power plants, less energy is left for people living in the slums.

These social concerns are serious because over 40 percent of Mumbai's population lives in slum areas. Yet slums cover only 3.5 percent of Mumbai's total land area,⁸ which makes them cramped and polluted. Although there have been many government projects to improve the lives of slum residents in Mumbai, the city is not equipped to provide electrical power to all these overcrowded areas.

In addition, many of Mumbai's poor residents cannot afford energy service. This means it is harder for them to perform basic household needs, such as cooking, cleaning, bathing, or boiling water for drinking. Instead, they must burn biomass fuels (wood, twigs, grass, animal dung, and plants), and must use the city's canals for cleaning and bathing. Basic services, such as heating, lighting, and regular water service, all require energy and are not available in many slums.

Think about it. How does the availability of nuclear energy affect the lifestyles of wealthier residents in Mumbai differently from the lifestyles of slum residents?

⁵ Hagen, "Nuclear Energy Thrives in Asia," p. 5.

⁶ Tripathi, "Enron versus 'Quit India,'" URL:
<http://www.asia-inc.com/archive/1995/1095investment.html>

⁷ Desai, *Community Participation and Slum Housing: A Study of Bombay*, p. 20.

⁸ Gupta, "The Mumbai Pages," URLs:
http://theory.tifr.res.in/bombay/stats/pop_stat/c91.html and
<http://theory.tifr.res.in/bombay/amenities/housing/slum-stats.html>

handout #2

How Nuclear Power Works

Fuels such as uranium and plutonium are put into nuclear reactors. The reactors split atoms in these fuels and release energy in the form of heat. This heat turns water into steam, which then powers a generator to make electricity.

Nuclear power is a clean technology when used properly. Nuclear energy does not deplete precious fossil fuels, does not pollute the air or water, and provides electricity to poorer countries that have little or no access to fossil fuels. In addition, large amounts of power can be generated. However, nuclear power plants are expensive to build and require careful maintenance and disposal of radioactive waste. When not built and maintained safely, the costs to people's health and the environment can be severe.

Glossary

biomass	plant material and animal waste used for fuel
fossil fuels	fuels derived from living things that have decomposed in the earth for millions of years
land grant	a transfer of the ownership of land from the government to individuals
landmass	a large area of land
nuclear reactor	an apparatus that initiates and controls a nuclear reaction to produce energy
plutonium	a radioactive metallic element
radiation	emission of radiant energy, which can cause sickness in people
uranium	a radioactive metallic element

MANILA: GEOTHERMAL OPTIONS

This handout concentrates on the use of geothermal energy in Manila. Although other forms of energy are available in Manila and throughout the Philippines, we will focus our discussion on one source. Use the glossary at the end of this handout to look up definitions of words.

Manila is the sprawling capital of the Philippines and was originally developed by Spain, which controlled the Philippines since the sixteenth century. For four centuries, the country was repeatedly colonized by different foreign countries, until finally gaining independence in 1946.

In 1975, the city of Manila incorporated surrounding communities and towns to become Metro Manila, whose current population is about 10 million people.

City Profile

As one of Asia's largest metropolitan areas, Manila is located on one of over 7,000 islands that make up the Philippine Archipelago. The name Manila is the combination of the words "may" (meaning "there is") and "nilad" (meaning "a mangrove plant") and refers to how early settlers made soap from the bark of the nilad plant that grew there.¹

Soap is still produced in Manila, along with hundreds of other goods, including textiles, luxury items, food, and leather products. Manila is the cultural, financial, and political capital and is home to many universities, banks, companies, and the Manila Stock Exchange. The city has also been the location of political protests and rallies, as during the 1986 presidential election when Corazon Aquino took over the government from Ferdinand Marcos.

Urban Energy Use and Lifestyle

One of the most serious problems the current president of the Philippines had to tackle was developing a reliable energy service for all the islands. During the early 1990s, the entire country was plagued by power outages that lasted several hours every day.² Power stations were extremely old and poorly serviced, and could not handle the needs of a growing population, especially in Manila.

Since then, energy service has improved. However, because of the country's extreme dependence on expensive oil for its energy, renewable energy options are being explored (especially geothermal energy). Although geothermal energy already provides as much as 40 percent of the Philippines' energy needs, there are projects to expand it 10 percent annually over the next ten years.³ By 2010, the Philippines is expected to handle over half of Asia's geothermal energy generation.⁴

The push for developing geothermal energy stems from the country's desire to be less dependent on commercial energy. Geothermal energy can be found locally, replaces imported oil, and is cheaper than commercial fuels. Geothermal energy also helps reduce Manila's intense air pollution, since it is fairly clean and does not cause acid rain or smog.

¹ Peters, *Philippines*, p. 96.

² *Ibid.*, p. 16.

³ Fesharaki et al., *Pacific Energy Outlook: Strategies and Policy Imperatives to 2010*, p. 34.

⁴ *Ibid.*, p. 89.

handout #3

For urban residents of Manila, the benefits of geothermal energy are great. Geothermal plants are reliable, and can operate throughout the year despite rain and drought. There are fewer chances of power outages that can cause havoc in the daily lives of urban residents. For industries, the possibility of continuous, reliable power helps increase their production of goods.

Geothermal Energy and Indigenous Tribes

Because the Philippines is a collection of islands, geothermal plants are located on numerous smaller islands surrounding Manila. Power is then transferred to the capital city through power stations along the way. The area surrounding Manila is undeveloped, and some power plants are built in forested areas inhabited by minority tribes. For these indigenous peoples, geothermal plants can seriously disrupt their ways of living.

A geothermal project underway in another part of the Philippines provides an example. Mt. Kanlaon National Park (a large park around the Kanlaon volcano on Negros Island) is home to a nomadic tribe called the Ati, who hunt, farm small fields of rice and vegetables, and build temporary huts out of twigs, branches, and grass.⁵ Mt. Kanlaon National Park is also the site of a new geothermal project being developed by the Philippine National Oil Company. Although this project is not designed to provide energy for Metro Manila, it nevertheless is a good example of how geothermal plants affect the local people.

In early 1997, President Ramos allotted over 500 acres of the park's rainforests to this project's exploration, even though the entire park was designated as a protected area because of its rare plants and animals. In order for energy plants to be built, Mt. Kanlaon National Park must be explored and cleared of trees.

The island's provincial government opposed this project, claiming it would disrupt the lives of local communities by eroding the soil, reducing the amount of trees, and completely changing the shape of the land from drilling and construction. The local government also claimed their residents would suffer increased water pollution from the wastes of geothermal energy.⁶ However, this project has strong support from people who claim that more energy must be provided for the surrounding area.

A program is being implemented to provide tribes living in the park with new ways of living, since some of their lands risk not being reforested after exploration is finished. The lack of forestation can bring diseases to farms, plants, animals, and people. The development of geothermal energy therefore can cause these tribes losses in life, home, income, and land.

Think about it. How does geothermal energy affect the lifestyles of urban residents differently from the lifestyles of tribes living near the geothermal plants?

⁵ Peters, *Philippines*, p. 34.

⁶ FT Asia Intelligence Wire, *Businessworld* (Manila), p. 7.

How Geothermal Energy Works

Geothermal energy comes from heat in the earth. This heat is trapped in the earth's upper crust in the form of water and steam, as seen in hot springs and natural geysers. When these reservoirs are drilled, heat is transported to power plants through insulated pipes, and then converted into electricity.

Geothermal energy is a renewable resource. Across the world, geothermal resources are so large, some think the world will not run out of them. This type of energy is one of the most promising long-term energy sources for the Philippines, since the islands have active volcanoes.

Glossary

acid rain	rain containing dangerous chemicals
archipelago	a group of islands
colonize	to establish a settlement of people in a territory
commercial energy	energy that is not supplied by individuals but must be bought from the government or private companies
geothermal energy	energy produced from the heat of the earth
geyser	a spring of heated water and steam
havoc	confusion or destruction
implement	to carry out a plan and put it into operation
incorporate	to unite separate entities into one whole
indigenous	native to an area
mangrove	a type of tropical tree that grows by the ocean
nomadic	roaming from place to place to live
renewable energy	energy whose source can be replenished
reservoir	a place where water is stored

handout #4

THINKING IT THROUGH

City Background and History

In which country and region of the country is your megacity located?

List three historical facts about your megacity:

1. _____
2. _____
3. _____

List three major industries in your megacity:

1. _____
2. _____
3. _____

List 3 interesting aspects of your megacity:

1. _____
2. _____
3. _____

Energy Use and Lifestyle

What type of energy did you study in your megacity?

List two groups affected by your megacity's energy use:

1. _____
2. _____

Do these two groups have different access to the energy you studied? If so, how?

Are the lifestyles of these groups different or similar? Explain below.

Can you think of any cultural values that might be different between the two groups?

Presentation Pointers

You'll be using the information collected on this worksheet to prepare a presentation of about 10 minutes on your megacity.

- Discuss with other group members what to write and say.
- Divide up the work.
- Write your ideas and information on the poster paper.
- Each group can have a lead spokesperson, but each person should present at least part of the project.

Your group could prepare any or even a combination, of the following:

- A chart summarizing key ideas
- Short paragraphs describing your megacity
- Bulleted points listing key ideas and organized into categories
- Web diagrams
- Pictures illustrating your ideas, with written explanations

handout #5

AN ENERGY THEORY¹

Sociologists have studied how energy affects people's activities and their cultural values. One theory on the relationship between energy and people divides societies into either low-energy or high-energy societies.

Low-energy societies use energy mostly from plants and animals (food, wood, vegetable waste, animal dung, and human labor). High-energy societies use modern energy sources (such as fossil fuels, nuclear power, and hydroelectricity) and discard most vegetable waste and animal dung.

Look at the chart below. Keep in mind that most countries today use a variety of energy sources depending on their purpose. People in these countries probably show characteristics of both low- and high-energy societies. Think of energy use as a continuum—this chart describes societies at two ends of this continuum. Can you recognize any of these characteristics in your megacity?

Low-Energy Societies <i>Lifestyles</i>	High-Energy Societies <i>Lifestyles</i>
Society is agricultural. Energy (primarily human and animal labor) is used in food production.	Society is urban. Energy is used mostly in industries and transportation.
The family produces most of its goods and services.	Goods and services are produced outside the family.
Lifestyles tend to be controlled and conservative.	Lifestyles can be diverse because of a range of energy options.
Life and work revolve around nature's weather or seasons.	Work is not dependent on nature's weather or seasons.
People keep warm or cool by adding or taking off clothes.	People keep warm or cool by heating or cooling their buildings.
Average age is lower than in high-energy societies.	Average age is higher than in low-energy societies.
People are fairly self-sufficient and do not depend on outside services.	People depend on the services of groups (such as garbage collectors) who can disrupt society (for example, by going on strike).
People eat less meat and more starches and vegetables.	People eat more meat, and more food in general.

¹ Cook, Earl. *Man, Energy, Society*. San Francisco: W.H. Freeman and Company, 1976.

handout #5

Low-Energy Societies <i>Cultural Values</i>	High-Energy Societies <i>Cultural Values</i>
People are valued for their contribution to society's welfare.	People are valued for the goods they produce.
A person's value and status in society come from one's family background.	A person's value and status come from their economic and political status.
Nonconformity and innovation are discouraged.	New ways of production, speedy service, and extensive communication networks are valued.
Society is valued over the individual.	The individual is valued over the society.
A person's status increases with age.	A person's status can decrease with age, as they are able to produce less in later years.
Patterns of behavior tend to be repetitive.	Patterns of behavior change rapidly and frequently.
People remain in the same communities in which they were raised. Physical and social mobility is limited.	People move frequently. Social mobility is possible through economic and political methods.

Personal Reflections

Many activities of people around the world fall into these categories:

- producing and preparing food
- working in an office or building
- working in agriculture
- transporting goods or people
- bathing and cleaning
- finding or maintaining shelter

All of these activities depend on energy. Depending on a society's technological advancement, economy, and natural resources, people will have access to different types of energy. This availability of energy affects what they can or cannot do in their daily lives. The theory you studied claims that the cultural values of people are greatly affected by their energy use. People's values naturally develop according to what furthers their access to energy sources, which are necessary to survive. Do you agree or disagree? Explain below:

Think about your daily activities. List three activities below:

1. _____
2. _____
3. _____

handout #5

Write down what types of energy are required for these three activities:

1. _____
2. _____
3. _____

Consider if those types of energy were no longer available. How would your activities change? Would you still continue them or would you do things differently? Explain below:

Do you think this change in energy use would affect your values in any way, even in the smallest ways? Explain below:

Where does your own community lie on the continuum of energy use?

Can you recognize any of your community's values in the energy theory you studied? If so, how?

SUMMARY CHART

	Beijing	Mumbai	Manila
Historical Facts			
Major Industries			
Energy Studied			
Two Groups Studied			
Types of Energy Used			
Differences in Lifestyles			
Differences in Cultural Values			

BANGKOK AND THE SCOPE OF WATER POLLUTION

Organizing Questions

- How can Bangkok's water pollution problems be examined from various perspectives?
- In what ways are these perspectives interdependent?
- What significance does water have in Thai culture?

Introduction

"In a very real sense, water is life. Life on Earth started in water and without water, life as we know it could not continue. Water transports nutrients and chemicals within the biosphere allowing life in all its forms to continue. Plants and animals alike have a fundamental dependence on water. Water also moulds the surface of the Earth. ... Everyone is concerned with water and thus everyone has a stake in how the resource is managed. Individuals and groupings of people have very different perspectives on water problems and on the best ways of management depending on the viewpoint and the bias of the group." (Young et al., *Global Water Resource Issues*, pp. xiv, 23)

Water pollution is the most serious environmental concern in Southeast Asia. Researchers estimate that the cause of 80 percent of all diseases and over one-third of all deaths in developing countries is due to the consumption of contaminated water. Water pollution is a complex and difficult problem to solve. In studying it, students must approach it with an understanding of the various dimensions impacting the situation. This lesson helps students gain an understanding of the multifaceted issue of water pollution, in order to strengthen their abilities to analyze a situation from multiple views.

Part 1 of this lesson explores the historical, political, and economic aspects of water. Students work in separate groups to examine different questions on a main reading passage, listing causes and effects within these three dimensions.

Part 2 has students continue to study water pollution, but from the perspectives of population and industrial growth. Students then synthesize the information collected in the two parts in a summary chart.

lesson three

Part 3 is an expansion upon the previous two. Students draw a group web diagram to visually illustrate the interconnections between the dimensions of water pollution. They then compose written passages to demonstrate their impressions and information about the subject. Enrichment activities are provided to supplement the day's lesson.

Part 4 focuses on Thai culture and some of its traditions involving water. Students study an important water holiday in Thailand, as well as read about other customs that depend on water. They consider ways in which these traditions compare to uses in their own communities, and consider how these traditions might be threatened by water pollution.

Objectives *knowledge*

- to understand the multiple perspectives of water pollution in Bangkok
- to obtain a broad picture of the city and its character as a megacity
- to see connections between the various aspects of a megacity and water pollution
- to understand the relationships between these multiple aspects
- to understand the role water plays in Thai cultural traditions
- to make connections between environment and culture

attitude

- to appreciate the complex nature of a megacity
- to approach a subject from many points of view
- to be sensitive to the multiple issues involving environmental pollution
- to understand how environmental pollution can affect people's lives
- to appreciate different cultures, religions, and ways of thinking
- to see similarities and differences in the cultural uses of water

skill

- to work effectively in small groups
- to summarize a reading passage succinctly and extract its major points
- to see connections between water pollution's causes and effects and be able to articulate them
- to use multiple forms of representation in understanding information
- to analyze and synthesize information

lesson three

Materials

- to see connections between environment and culture and be able to articulate them
- Projected Megacities of the World, 2015, transparency (from lesson 1)
- Geographic Features of Bangkok, for the teacher
- Handout #1, The History and Politics of Water, one per group of four or five students
- Handout #2, Causes and Effects, two per group of four or five students
- Handout #3, Comprehension Questions, one copy
- Handout #4, Coping with Population and Industrial Growth, one per group of four or five students
- Handout #5, Comprehension Questions, one copy
- Summary Chart, transparency
- five or six sheets of poster-size paper
- Tape
- Color markers
- Web Diagram, for the teacher
- Handout #6, Creating Meaning with Water, one per group of four or five students
- Handout #7, Life on Water, optional

Procedure— Part 1



1. Explain to students that in this lesson they will study the megacity of Bangkok and the water pollution problems Bangkok faces. In part 1, they will study water pollution from the dimensions of history, politics, and economics.
2. To begin this lesson, first have students identify where Bangkok is on the transparency, Projected Megacities of the World, 2015. Ask them what continent it lies on, and of which country it is the capital. Also have students identify the major body of water bordering Bangkok (i.e., Gulf of Thailand). Using the Geographic Features of Bangkok, you may also want to introduce other geographic features of Bangkok.
3. Using a blank transparency, brainstorm with students about what they think the major sources of water pollution are in general, what common factors influencing this problem are, and why they think it might be important to have clean water in a community. Students should use their own personal experiences with water pollution in their communities as a source of information. Explain to students that they should consider these initial ideas as they study water pollution in Bangkok, and that they will compare the two situations later in the lesson to explore similarities and differences.

lesson three



4. Distribute copies of Handout #1, The History and Politics of Water, and Handout #2, Causes and Effects, to small groups of four or five students. Cut Handout #3, Comprehension Questions, into strips and give one question strip to each group. Have students read through Handout #1, using it to discuss the question strip.
5. As students discuss the answers to their question strip, have them jot down key phrases and words on Handout #2, Causes and Effects. The purpose of this activity is for students to see the relationships between certain events, people, and organizations and their effect on water quality, such as:

Causes:	Effects:
need for city's defense	surrounding canal built
seasonal flooding	homes built on water
water pollution	need for environmental laws

Procedure— Part 2



1. Explain to students that they will continue activities from part 1, in which they studied Bangkok's history, politics, and economics and their effects on water pollution. In part 2, they will study water pollution from the perspective of population and industrial growth.
2. Distribute Handout #4, Coping with Population and Industrial Growth, and give each group a copy of Handout #2, Causes and Effects. Cut Handout #5, Comprehension Questions, into strips and give one question strip to each group. Have students read through Handout #4, using it to discuss their question strip.
3. As students discuss the effects of population and industrial growth on water quality, have them list on another copy of Handout #2, Causes and Effects, certain phrases such as:

Causes:	Effects:
better nutrition	more people
demand for more manufactured goods	more industries
more industries	more chemical waste
more surface water pollution	need for other water sources



4. Using the transparency, Summary Chart, have students volunteer answers to the five columns entitled "Historical," "Political," "Economic," "Population Growth," and "Industrial Growth." Answers given by the students should relate directly to phrases and words listed on Handout #2.

lesson three

5. Referring back to the transparency (part 1, #3.) in which students initially brainstormed ideas about water pollution, discuss what similarities and/or differences there are between the situations in Bangkok and in their own communities. Consider using the categories of history, politics, economics, population growth, and industrial growth as guidelines to lead the discussion.



This activity could then be followed up by having students write in their journals, or by having students write a short essay as a homework assignment.

Procedure— Part 3

1. Review the Summary Chart with the class.
2. Pass out several markers to each group and make sure they have Handout #2, Causes and Effects. Tape the sheets of poster paper to a large wall space to form at least a 6' x 8' rectangle. This activity might also be done on the floor as long as students can walk around and view the paper from all sides.
3. Explain to students that the class will be constructing a web diagram to help them visualize the dimensions of water pollution in Bangkok. Begin the diagram by drawing a central circle containing the term "Formation of Bangkok" in the middle of the paper.
4. Have each group begin drawing smaller circles webbing out from the central one, according to the issues addressed in their question strips. The teacher should remind students to review the Summary Chart or Handout #2, Causes and Effects, for ideas to label smaller circles. Students can also reference the vocabulary words listed on Handout #2 in drawing outward branches of the diagram. The teacher may refer to the Web Diagram for ideas.
5. Once the diagram is completed, lead the class in a discussion of the following (but not limited to these):
 - Which paths lead to cleaner water?
 - What are the hindrances to cleaner water?
 - What elements are necessary for cleaner water?
 - Where are there overlaps in the various paths?
 - Were students surprised about any effects or causes of water pollution?
 - What similarities do students see between Bangkok's water situation and that in their own communities?
6. Students can follow up this discussion with journal entries describing their impressions of water pollution (e.g., hypothesizing how Bangkok might be in 20 years, brainstorming possible solutions for water pollution, drawing a web diagram for their own communities, etc.).

lesson three

7. Extending this lesson with Enrichment Activities #1, #2, or #3 after part 3 would enhance students' understanding of the materials.

Procedure— Part 4

1. Explain to students that they will examine the importance of water in Thai culture and think about ways that water pollution might endanger those traditions. They will also consider how Thailand's water traditions differ from their own.
2. Begin the lesson by asking students to brainstorm ways in which water is used in their own communities or cultural groups. Write students' ideas on poster paper or on the blackboard, organizing them in categories such as "Religion," "Recreation," "Utility," "Health," etc. Encourage students to think particularly about how water is used in cultural contexts.
3. Distribute Handout #6, *Creating Meaning with Water*, to the class as a whole. Explain to students that they will be reading about some water traditions in Thailand and comparing them with traditions in their own communities or cultural groups. Have students read the handout.
4. After students finish reading, ask them how Thai traditions compare with their own. The teacher should write the Thai traditions on the same poster paper or blackboard as was used in the students' initial brainstorming, with the same categories. Referring to Handout #6, compare how Thai culture and the students' culture use water, noting both differences and similarities. Then ask students to think about how Thailand's water traditions, and their own, might be threatened by water pollution. This may be done in group discussion, written on poster paper or the blackboard, or completed by students in journals. Some examples of how Thailand's traditions might be threatened include:
 - possibly unhealthy practices (e.g., throwing water on one another)
 - less water available for non-utilitarian purposes
 - a diminished purifying role that water plays when polluted
 - less attention given to traditional ways of life in modern times

Optional Activity

1. Have students read Handout #7, *Life on Water*.
2. Ask students to imagine how their life would be if they depended on a boat for transportation, work, etc. Possible questions to discuss are:
 - What would transportation be like, to the store, to work, or to school?
 - How would you bathe yourself, wash your food, and wash dishes and clothes?
 - How would you dispose of your household waste?

lesson three

- What kind of work would you do? Would you work on land or sell goods from the boat, or both?
 - How would you build your boat and with what materials? Would you change your materials because of water pollution? Would the boat be motorized or not? Why?
 - How would you handle the monsoon rains when your house might flood?
 - What would be your drinking supply? Would you still use the canal water even though it was polluted? How could you clean the water?
 - How many people would live with you in your river house?
 - Would you allow your children to swim in the canals, when Bangkok has virtually no public swimming pools?
 - How would you handle the tropical climate, where temperatures reach 110 degrees Fahrenheit?
 - Do you think you'd have more or less privacy and safety in a river home?
3. When students have envisioned a life for themselves by a canal in Bangkok, ask them to imagine how their life would change with increased water pollution. How would water pollution affect or restrict their lives? Water pollution could influence:
- food supply
 - cleaning of food, clothes, and utensils
 - bathing and general hygiene
 - health problems
 - lack of clean drinking water
 - problems from flooding
 - quality of living

Enrichment Activities

Activity #1: Community Interviews

- Students go out into their communities to interview family members, neighbors, friends, teachers, and officials about their experiences with water pollution.
- Students bring these stories back to class, share them with the group, and possibly analyze them according to the dimensions of politics, economics, history, population growth, industrial growth, etc. Discuss how there are similarities and differences with Bangkok's situation.
- The use of Venn diagrams, showing by overlaps where there are similarities between both situations, might be particularly helpful and visual for students.

Activity #2: Poem or Song

- As a class or in separate groups, students compose a poem or song on the uses of water and/or on water pollution. Ask them to share their impressions, concerns, thoughts for solutions, etc.

lesson three

Activity #3: Group Mural

- Students draw a mural chronicling the formation and development of Bangkok.
- Students can choose to draw in elements representing the influx of people and industries, their impressions of living by polluted canals, homes on the river, transportation by boat, growth of roads, etc. They should add any facts, prose, or writing pieces that relate to the mural. These can include journal entries, names, definitions, dates, figures, and feelings.
- The class can then enter a discussion, with the teacher asking students to volunteer why they drew or wrote certain elements and to explain their understanding of Bangkok's water pollution.

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GEOGRAPHIC FEATURES OF BANGKOK

Major Points to Cover:

- Thailand lies on the continent of Asia, in Southeast Asia. Thailand's climate is tropical, hot, and humid.

Optional: Thailand has four broad regions, each of which has a particular topography:

Central: Mostly flat land with low-lying hills.

Northwest: Mountains with tropical forest regions, especially near the borders of Burma and Laos.

Northeast: Mixture of flat land with mountains and tropical forest regions near the borders of Laos and Cambodia.

South: Extremely long narrow region with beaches along the coastline and some mountains; includes numerous small islands.

- Bangkok, the capital of Thailand, lies in the central lowland region of the country.
- Bangkok is north of the Gulf of Thailand, formerly called the Gulf of Siam. The Gulf of Thailand is partially enclosed by Vietnam and Cambodia on one side and the Malay Peninsula (comprised of Burma, Thailand, and Malaysia) on the other.
- The Chao Phraya River, Bangkok's chief river, flows through the city into the Gulf of Thailand (south of Bangkok). It also extends northward beyond Bangkok.
- Bangkok has a series of canals, which students will be studying in part.

handout #1

THE HISTORY AND POLITICS OF WATER

While reading this handout, consider the importance of water in the early history of Bangkok and in the life of its people. Also consider the issues involved in how Bangkok's government handles its water services.

Bangkok has been described as an icon of Thailand, much the way Paris represents France or New York symbolizes the United States. It's perhaps the world's best example of a "primate city," which means the city dominates all other cities in the country, in terms of its size, industries, wealth, population, and political influence.¹ Bangkok is also described as the "Venice of the East," because the city is built in part on water and has many canals.

Building History with Water

Bangkok was founded in 1782 by King Rama I as the new capital city after the destruction of Thailand's ancient capital by the Burmese. The Thai name for the city means "City of Angels." The city was built on the Chao Phraya River as an island, with a canal (called "klong" in Thai) encircling it. The island was shaped in the form of a sacred conch shell, a form in which many traditional Thai villages were shaped.² King Rama I wanted to mold the city into this symbolic shape to evoke the glory of their ancient capital. Bangkok used this canal for defense, transportation, and trade.

As the city expanded, additional canals were built in concentric arcs around the first one. Connecting canals were also built between the main ones, creating a network of transportation. This intricate network of waterways was the Thai version of a modern road system. Not until 80 years later would Thais start building roads in Bangkok.

No longer shaped like an island, Bangkok today is a sprawling metropolis covering 970 square miles. Although Thailand is still ruled by a king, the city is led by an autonomous city government called the Bangkok Metropolitan Administration (BMA). The BMA handles the city's basic services, including those involving its water.

Living with Pollution

In Bangkok's early history, water was vital for transportation and was the home for most Thais at that time, who lived in bamboo water rafts. They did so for practical reasons. When the monsoon rains came, the river homes just rose with the tide. There were no problems with flooding, and life went on as before!³ Today however, most residents live on land instead of water, and travel by car instead of boat. When they do travel by boat, they use noisy river taxis, which are motorized boats that spew much exhaust into the canals.

Most of Bangkok's water canals have been filled in to become roads to handle the increasing numbers of people, cars, and other motor vehicles. While most residents have access to piped water, very few have sewage service. This means wastewater is often dumped into the rivers and canals, for lack of another disposal method. The city collects solid waste in cesspits and septic tanks, which are often poorly constructed and maintained, causing leakage problems. Liquid waste often pours out of these containers into the drinking water supply, and during floods, sewage can flow into residential areas.

¹ Rigg, *Southeast Asia: A Region in Transition*, p. 134.

² Van Beek, *Insight Guides: Bangkok*, p. 37.

³ *Ibid.*, p. 38.

Because many people live next to where domestic waste is disposed, diseases develop rapidly as people bathe in and drink polluted water. Water pollution is the cause of many deaths and sicknesses in Bangkok, especially among children. In addition, the smell from the canals and rivers can be overpowering.

The Role of the Government

Although some levels of domestic waste can be removed economically from Bangkok's water supply, Bangkok does not have the budget to install a new sewage system. A new system has been estimated to cost \$1.5 billion!⁴ A lack of money to change how Bangkok handles its sewage, and a lack of coordination among the BMA and other governmental agencies, have led to ineffective dealings with the problem of water pollution.

Because Bangkok's industries have expanded so quickly, the city has not been able to keep pace in its management of water. Government agencies have typically focused more on the quantity of Bangkok's water supply, rather than the quality. Unfortunately, the problem in the city is more a problem of quality than quantity.

There has been a lack of legislation controlling how industries dispose of their waste, and ineffective planning on how best to handle the population and tourist growth in relation to the city's water supply. Unfortunately, the BMA has had difficulty coordinating plans with city service agencies under the central government of Thailand, which has created confusion and ineffectual planning of Bangkok's water services.⁵ In addition, corruption in parts of the city's government has also made it easier for industries to bribe officials to ignore environmental regulations.

⁴ Rigg, *Southeast Asia: A Region in Transition*, p. 149.

⁵ *Ibid.*, p. 156.

handout #2

CAUSES AND EFFECTS

As you discuss Handout #1 or #4 and your particular question, write down words or phrases from the text that involve specific causes and effects. Keep in mind some of the words below to help you as you record causes and effects.

Terms from Handout #1:

capital city	sewage service	dumped waste	leakage problems
island	drinking water	tourism	conch shell
canals	city defense	transportation	legislation
flooding	diseases	smell	population
river homes	city budget	BMA	domestic waste
roads	industrial waste	foreign trade	Chao Phraya River

Terms from Handout #4:

heavy metals	below sea level
soil subsidence	nutrition
nondegradeable	employment
chemicals	manufacturing
higher wages	waterlife
pumping for water	underground
industrial growth	

Causes	Effects
flooding	river homes

COMPREHENSION QUESTIONS

What means of defense were used when Bangkok was founded?

How did King Rama I use water in a symbolic way?

How was water used in a utilitarian way in Bangkok's early days?

How does Bangkok's current use of water affect its water quality and quantity?

What administrative difficulties does the BMA face?

How is public health threatened by water pollution?

What problems do Bangkok residents face in terms of sewage disposal?

What economic difficulties does the BMA face?

handout #4

COPING WITH POPULATION AND INDUSTRIAL GROWTH

This handout illustrates how population and industries affect a megacity's environment and water supply. How do they affect Bangkok's water quantity and quality?

Bangkok's population has risen rapidly within the last decade, from 5 million to over 7 million people. At the same time, Bangkok's industries continually increase as more foreign and domestic industries emerge. This population and industrial growth has put tremendous pressure on the city's housing, transportation, public services, and particularly its water supply. It has also significantly increased the amount of pollution caused by domestic and public use.

Reasons Behind Bangkok's Growth

Three main reasons account for the population growth. One reason is increased longevity due to better nutrition, lower infant mortality rates, and better medical service. A second reason is the influx of migrants moving to Bangkok in search of employment and higher wages. The third reason is the expansion of the city into the surrounding countryside. Many new industrial parks have sprouted up in the outskirts of Bangkok as a result of the influx of business and industry,¹ and, have attracted workers from outside Bangkok.

Industries within the city also grow every day. Business is booming in Thailand, and foreign trade has been a big reason for these rapid changes. Since the 1980s, foreign investors have been interested in Thailand for its exports, inexpensive labor, and tourism. Whereas Thailand exported mostly agricultural and other food goods before, it now exports many manufactured products as well. A great number of small-scale factories are producing items to be distributed across the world. Most of these products are textiles, building materials, and electronic equipment.

The Impact of People and Industry

The population explosion has led to more household waste, which is often discharged directly into the canals, or through storm drains connected to the waterways.² As a result, the lower part of the Chao Phraya River, which is a major source of water, is severely polluted, mostly from domestic waste.³ Fifty years ago it was home to fish, alligators, and other waterlife, but they have since disappeared because of inadequate oxygen in the water.

Bangkok's industries use water mostly for cooling and cleaning purposes in manufacturing goods.⁴ After having used this water, many industries dispose of it directly into the city's canals and rivers without water treatment. Particularly harmful materials come from the electronic and machinery industries, which use heavy metals and nondegradable chemicals. Unfortunately, to remove these metals and toxins from the water is expensive and time-consuming. To not do so, however, leads to more diseases and the destruction of waterlife.

Tourism is another major industry of Thailand that impacts Bangkok's water quality and supply. To handle the influx of tourists, Bangkok has built more hotels, restaurants, shopping centers, etc. Yet, the city has not expanded its sewage system to accommodate

¹ WHO, *Urban Air Pollution in Megacities of the World*, p. 49.

² Krongkaew, in *Emerging World Cities in Pacific Asia*, p. 321.

³ Brandon and Ramankutty, *Toward an Environmental Strategy for Asia*, p. 49.

⁴ *Ibid.*, p. 142.

this growth. The tourist industry has therefore not only put more demand on Bangkok's water supply, but has also led to more waste disposal in the canals.

The Consequences of Water Pollution

As Bangkok's surface water becomes increasingly polluted, Thais have had to search elsewhere for cleaner water to meet the demand. They have resorted to moving to the upper levels of the Chao Phraya River for cleaner water. They have also tapped underground water. Pumping water from under the ground has led to "soil subsidence" throughout Bangkok. Soil subsidence means that the soil sinks or compresses in the ground, weakening the foundation of buildings and causing more flooding. Bangkok is literally sinking, and some predict many areas of the city will be below sea level in ten years!

handout #5

COMPREHENSION QUESTIONS

What are the main reasons for Bangkok's population explosion?

What are the main reasons for Bangkok's industrial growth?

What role does tourism play in water pollution?

How has Bangkok coped with water pollution, in terms of water supply?

What role does industry play in water pollution?

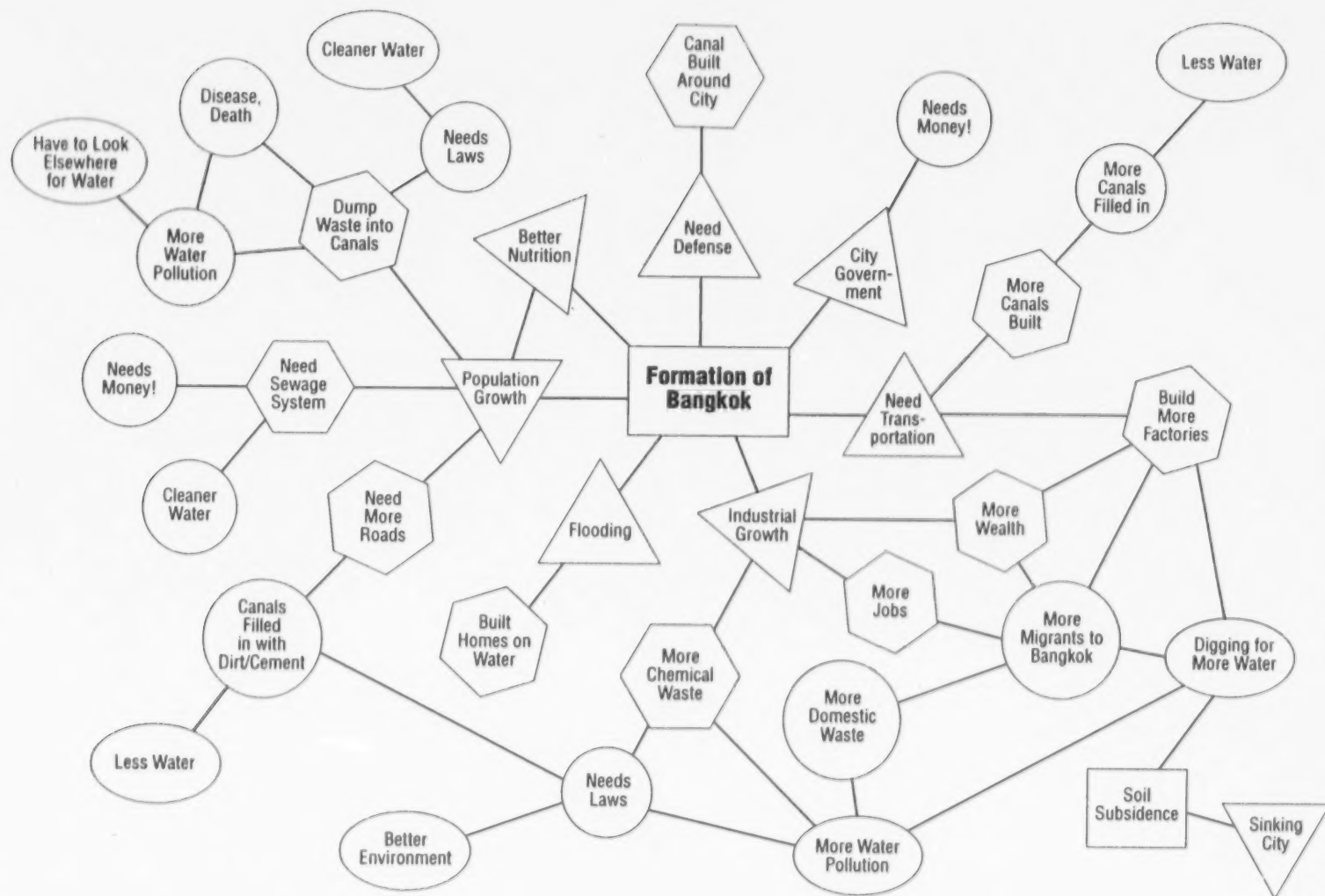
What is the relationship between population growth and industry in Bangkok?

What are some of the environmental consequences of population growth?

What possible future do you foresee for Bangkok?

SUMMARY CHART

		Historical	Political	Economic	Population Growth	Industrial Growth
Causes	1	flooding		need money to build sewer system		
	2					
	3					
	4					
	5					
	6					
	7					
Effects	1	river homes built on water		can't build new sewer system		
	2					
	3					
	4					
	5					
	6					
	7					



CREATING MEANING WITH WATER

As you read this handout, consider how the Thai traditions using water are different from your own cultural traditions, and how they might be similar.

"At night on the last day of the old year, puppets representing gray-haired, decrepit spirits dressed in white are made, symbolizing the old year. The puppets are drawn out along the river with old clothing and other old belongings behind them. Then they are thrown into the stream and they float away. In the early hours of the morning before dawn, parents rouse their children out of their slumber to observe the spirits of the previous year running away. If the spirits cannot be seen, everyone must go deep into the forests of the mountains so that they can be sure to see them. What child, however, would dare to venture out into the dark night and deep forests just to catch a glimpse of the hoary spirits of the old year passing away?" (quoted in Tomosugi, *Changing Features of a Rice-Growing Village in Central Thailand*, p. 73)

This excerpt is part of a Thai folktale told to young children to celebrate the coming of the new year. The new year is celebrated with a national festival called *Songkran*, which lasts from April 13 to 15. The old year is signified as "gray-haired, decrepit spirits dressed in white," which are swept away by the river's currents, so that the new year may come. The flow of water symbolizes the movement of time, and purifies everything that passes through it.

Water is very symbolic in *Songkran*, and appears not only in traditional Thai folktales about the holiday, but also in the actual celebration of the festival. *Songkran* is known as the "throwing water" festival, because the holiday comes at a time when the hottest season of the year is just ending and the new year is starting. Thais not only want relief from the incredibly hot, muggy weather, but also want to celebrate the coming of the new year and the rainy season.

They throw water on each other, as a symbol of goodwill, affection, and celebration. Any social problems one might have with another person are forgotten during *Songkran*, as people wash away their troubles by throwing water on each other and begin the year anew. It is hard to escape having water thrown on you, and as people walk down streets in villages or cities, strangers will throw buckets of water on you unless you're careful. It's not uncommon to see people completely drenched, making them change their clothes several times in one day! During *Songkran*, schools are closed, and at night people go to their local Buddhist temple where there is entertainment such as movies, food, and games.

Songkran is not the only Thai Buddhist tradition involving water. There is another famous water festival called *Loy Krathong*, which takes place in November and is said to have been celebrated in Thailand since the thirteenth century.¹ It is a festival held at night, in which Thais float elaborate boats (krathongs), made out of green banana leaves or paper, down rivers and canals. These small boats carry a variety of decorations, such as candles, incense sticks, coins, or flowers. Thais hope that the "Mother of the Waters" will bring them good luck and blessings. Thousands of boats floating down the rivers, lighted by shimmering candles, make *Loy Krathong* one of Thailand's most beautiful festivals.

The great "Mother of the Waters," worshipped in *Loy Krathong*, is a benevolent spirit who provides water and good luck for people. Water spirits in Thai culture are not always helpful, however. One spirit, *phrai nam*, lives in rivers and causes people to drown. These

¹ Van Beek, *Insight Guides: Bangkok*, p. 216.

handout #6

two spirits symbolize the dual nature found in humanity; the good spirit represents social order while the evil spirit symbolizes disorder and misfortune.²

Water plays a symbolic part not only on national holidays, but in Thais' everyday life. Thai families have small "spirit houses" to guard their homes against evil spirits and misfortune. The spirit houses look like miniature, ornate temples on stilts. Every day, Thais offer water, food, incense, and candles to the spirit house to ensure domestic happiness. Water is also used to protect one's family ancestors. Thais believe their family ancestors will be reincarnated, and if endowed with merit through a special ritual of pouring water (called *kruat nam*), their ancestors will find happiness in future lives.³ Buddhist monks also use water in temple ceremonies, where they lightly spray water on worshippers to bless them.

² *Ibid.*, p. 29.

³ Tomosugi, *Changing Features of a Rice-Growing Village in Central Thailand*, p. 27.

LIFE ON WATER¹

by Pearl Kim

This is a hypothetical story about life on Bangkok's canals. Try to imagine yourselves in the main character's position and how your life might change due to water pollution.

My name is Pattana Saengnam, but my Thai nickname is Noi. I am thirty-three years old, and live with my husband and two children along a canal in Bangkok. I was born and raised in Bangkok, and have lived near the water all my life. It's the only life I know, and although it can be very hard, I can't imagine living another way.

Bangkok's canals are always busy day and night, and the waterways are filled with cargo boats and sampans carrying all kinds of things up and down them. Large boats and ferries travel along the Chao Phraya River, while the smaller sampans and speedboats go along the canals. The larger boats transport coconuts and teak from the northern region of Thailand, and then reload with rice, sand, or sugar to take to other parts of the country and all over the world. Sometimes the boats carry hundreds of tourists as they sightsee along the river, which has many temples and historical sites. Other times they carry Bangkok residents as they commute to work, because it's quicker than taking the city buses or driving. Living on the canals can be pretty noisy with all the loud motorboats roaring by, but I've gotten used to it.

I sell fruit in the floating markets of Bangkok, which are famous tourist sites. In these markets, Thais sell fruit, vegetables, fish, and meat from their sampans. Every morning, I buy fruit from wholesalers who bring their produce from surrounding villages into Bangkok by truck. I sell pineapple, bananas, papaya, and sugar cane, all carefully arranged in piles on bamboo mats on my boat's floor. Sometimes I must row my boat for miles every day, which is hard work, as I travel around from market to market. Or sometimes I will sell fruit from house to house along the water.

My boat is small and narrow, made of wood. I have a bright red umbrella to protect me from the sun, which makes it incredibly hot to stay outside, especially during the afternoon. When I am working, I wear a bamboo hat, scarf, and long-sleeved shirt to protect my face and arms from the intense sun. Nevertheless, my skin has become very rough from all the years of work on my boat.

All of my neighbors own boats, just like me. We use them to get around, visit neighbors, or go to the market and temple. Traveling by car or foot takes too long, because the traffic in Bangkok is among the worst in the world. Sometimes during rush-hour traffic, it will take two hours to move a few blocks! That's not for me—I prefer to travel by water. Even though there is lots of traffic on Bangkok's canals, it's still more peaceful and the traditional way of life.

Traveling by boat is how Thais used to go places in ancient times. Back then, Thais also used to live in riverboats all year long. When the monsoon rains came, they wouldn't have problems with flooding, because their homes would just rise with the tides. Nowadays, however, most Thais live in stilt homes if they live by the water, just like I do. It can be more

¹ This passage was inspired by Garrett, *A Fulbright Year in Thailand: Bangkok Journal*; Gidal, *My Village in Thailand*; and the author's memories of Thailand as a Peace Corps volunteer.

handout #7

comfortable, and people have access to plumbing and electricity that way. We depend on the canal for bathing, washing dishes and clothes, and sometimes for drinking and cooking. But because the canal water is so dirty, we usually collect rainwater in a huge clay vat, filter it using coal, and use that for drinking and cooking.

The water in Bangkok is very polluted and smells terrible in some places, making it difficult to bathe and wash. Because Bangkok does not have a good sewage system, many Thais dump their waste into the water. In the past, this was not a problem because the high tides would wash the waste into the ocean, and replace the canals with clean water. But since more and more canals are being filled in with dirt to make room for streets as Bangkok expands, there are fewer ways the waste can be washed away. The waste now just accumulates where it is dumped, causing terrible pollution in the waterways.

When I was little, children would play and swim in the waters, especially during hot weather. These days children still swim in the canals, but it is very dangerous for them to do so. I read in the newspapers that people can get many diseases from the water, like cholera, dysentery, and typhoid. Although we would rather not bathe or wash our dishes in the canals, we have no choice. Where else can we go?

Fifty years ago when my father was a fisherman, there were many types of fish and animals in Bangkok's waters. Forests and orchards lined the banks of the Chao Phraya River. Today, unfortunately, water pollution has killed many of the animals and plants, and we can no longer depend on the rivers and canals for food.

Bangkok has changed a lot since I was little. But even though living on the water is difficult, I still wouldn't live anywhere else. All my friends and family live on the canals, and it is a Thai tradition. I hope that someday the water pollution will not force me to move, because it's really the only life I know.

WASTE MANAGEMENT IN TOKYO

Organizing Questions

- What are the major ways people in Tokyo dispose of waste?
- How viable are these methods for long-term waste disposal?
- What similar methods exist in students' home communities?

Introduction

"While the per capita amount of solid waste generated in Asian cities is small, the total amount of waste generated is significant. Currently, large metropolitan areas in Asia generate over a million tons of waste per year, and this is expected to increase rapidly with economic growth and continuing urbanization. The growth of solid wastes has strained the capacity of cities to collect and dispose of them. Uncollected solid waste presents major health hazards to populations, particularly the poor." (Brandon and Ramankutty, *Toward an Environmental Strategy for Asia*, p. 24)

In this lesson, students will first consider the different types of waste that humans produce, and will look at ways of sorting this waste into categories.

Next, students will learn how people in the megacity of Tokyo deal with the different types of waste produced, and will examine methods for managing waste. The characteristics of each method are explored as well as its potential for long-term use.

Finally, students will look at their own garbage production and how it might be disposed of in their communities.

Objectives

knowledge

- to learn ways of categorizing waste
- to understand basic issues of waste management in Tokyo
- to explore waste management in the students' home communities

attitude

- to appreciate differences in outlook among different countries
- to learn to view issues of waste management from multiple perspectives
- to critically appraise and evaluate the opinions of others

lesson four

- to provide alternative views or explanations of an issue

skill

- to articulate personal opinion in a group discussion
- to work harmoniously in small groups using effective listening and conversational skills
- to look critically at different choices available in managing waste
- to develop field research skills

Materials

- Handout #1, Developing a Garbage-Sorting Plan, one per student
- Handout #2, Tokyo Waste Management Summary, one per group of four to five students
- Handout #3, Management Method Sorting Chart, one per group
- Handout #4, Group Paper Planning Sheet, one per group, optional

Procedure— Part 1

1. Pass out Handout #1, Developing a Garbage-Sorting Plan, to each student. Have the class take a few minutes to write down all the different materials they used or will use for today's lunch. The students should list everything they use except what they eat. Some examples might be aluminum from cans and plastic from juice containers. Try not to suggest too much to the students at first. Try to get them to think critically about all the materials that made their lunch possible. The list should be as complete as possible.



2. Next, form groups of four or five students each, and have them think of useful categories for their combined lunch materials. They should imagine that they can no longer just throw waste materials into garbage cans. Again, try not to suggest too much at first. The idea is to start grouping the trash into categories so they can use a method to eliminate each category as a problem for the week. For example, some items are best grouped into a "reusable" category and simply cleaned and reused. Others might be grouped into a "burnable" category and simply incinerated. The important point is that each category should be tied to a method of management. Encourage creativity, diversity of methods, and completeness.
3. Finally, have students develop a summary table on the board. Have volunteers from various groups write a category and method of disposal on the board.
4. Explain to the students that they have created different "waste streams" by grouping the lunch waste into management categories. Have the students keep their categories in mind as they read about how the Japanese in the megacity of Tokyo organize and dispose of their waste. Distribute Handout #2, Tokyo Waste Management Summary, to each group.

lesson four

Present the following information to students to set the context for the rest of the lesson:

"Japanese households produced 50.3 million tons of waste in the fiscal year which ended March 31, 1994. This was enough garbage to fill up the Tokyo baseball dome 135 times."
("Waste Disposal Costs Soar to Record High in FY '93," *Japan Weekly Monitor*, August 12, 1996).

"Industrial waste for the fiscal year which ended March 31, 1993 amounted to 403 million tons." ("Industrial Waste a Record 403 Million Tons in FY '92," *Mainichi Daily News*, July 31, 1995)

Ask students to calculate approximately how many Tokyo baseball domes 403 million tons of garbage would fill. (Answer: 1,082)

"The Kanto region (including the megacity of Tokyo) produced 29 percent of all the industrial waste. Although 40 percent was eventually recycled, 22 percent or 89 million tons found its way into landfills." ("Industrial Waste a Record 403 Million Tons in FY '92," *Mainichi Daily News*, July 31, 1995)

Ask students to calculate approximately how many Tokyo baseball domes 89 million tons of garbage would fill. (Answer: 239)

Since Japan is an island with a highly dense population, the country faces many challenges to managing its waste disposal. Since land is scarce, the country will eventually run out of landfill sites. The country is already dumping waste directly into the sea. As a result of its limited landfill capacity, Japan makes extensive use of garbage incineration. However, this produces pollution that is released to the atmosphere, burns fossil fuel, and the ash must still be buried.

Some alternatives that Japan is exploring are increased recycling, burning garbage for power generation, and home composting.



Have each group fill in Handout #3, Management Method Sorting Chart, for each method. The students should identify the method (e.g., Tokyo Bay landfill), type of waste managed (e.g., non-burnable garbage, burned ash), the advantages to using this method (e.g., extra land for building things like theme parks), the disadvantages (e.g., toxins released into fishing grounds, running out of sites), and incentives for the public to support its use (e.g., landfills are often outside of densely populated communities).

5. As a class, have students discuss some of the following:

- Limitations of the main methods of Tokyo's waste management (e.g., air pollution, limitations of space, public awareness)
- Advantages of certain waste management methods (e.g., waste recycling reduces burning of fossil fuels for energy)

lesson four

- Different philosophies contained in the waste alternatives (e.g., waste reduction, reuse of "garbage" for energy)

Procedure— Part 2



1. Assign students a group paper on waste management in their communities. Explain that each group of students will have one week to go out into their community and research how waste is handled in their community. They will then write a paper and turn it in at the end of a week. The paper should address the five topics suggested on Handout #3, Management Method Sorting Chart (i.e., method, type of waste, advantages, disadvantages, and incentives to use). Students may wish to use Handout #4, Group Paper Planning Sheet, to help with the planning process.
- Encourage the students to look beyond the methods presented in this lesson. These topics can cover many other areas such as human waste, the garbage truck and where it goes, community recycling projects, etc.
 - Discuss basic report-writing skills. Encourage students to use pictures and graphs in their report and to document any references used, and encourage them to conduct interviews if possible.
 - As part of the group paper, have students include a report on the group process. This should be a one-page report on what each group member did, what roles each member played, and how the group handled conflict.

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lesson four

Sasamoto, Hiromi. "Garbage, Garbage Everywhere." *The Daily Yomiuri*, January 1, 1997.

Torii, Masashi. "Plant Energizes Waste Disposal." *The Daily Yomiuri*, March 8, 1997.

"Used Can Recycling Progressing Steadily in Japan." *Asia Pulse*, April 17, 1997.

"Waste Disposal Costs Soar to Record High in FY '93." *Kyodo News International, Inc., Japan Weekly Monitor*, August 12, 1996.

handout #1

DEVELOPING A GARBAGE-SORTING PLAN

Take a few minutes to write down all the different materials you used or will use for today's lunch. List everything except what you eat.

Material	From What Source?
plastic paper	sandwich bag lunch bag

What if the garbage cans disappeared?

The agency in charge of the school's garbage cans decides that it might be a good idea if the students appreciated its efforts a little more. The agency decides to take a vacation for a week and give the students a chance to figure out how to deal with garbage without having garbage cans.

Group Assignment:

Think of ways that you can eliminate the growing mass of garbage that would develop over the week from your lunch materials. You will not be able to simply collect the garbage in other containers for removal when the garbage cans come back. Your team must think of a permanent way to eliminate the waste so that it doesn't just accumulate on the school grounds or cause a health hazard to others.

As you start to think of methods, start grouping the different materials together into common categories and list them in the following table.

Category	Materials	Method of Management

TOKYO WASTE MANAGEMENT SUMMARY

Method 1: What Can't Be Burned Often Gets Buried (Nonburnable waste)

Just a half-hour drive from the skyscrapers of central Tokyo lies Tokyo Bay. On the edge of Tokyo Bay, surrounded by water, lies an interesting landmark that might be recognizable to children all over the world, Tokyo Disneyland. Here, there are familiar cartoon characters and rides just like in California. To truly understand the history of this theme park, though, it is necessary to visit another Tokyo Bay site filled with a jigsaw puzzle of man-made islands and passages for boats.

Here, every day, 3,500 to 4,000 trucks come to dump their garbage from Tokyo's twenty-three wards. This "landfill" on the bay is twenty times the size of Tokyo Disneyland. In 1996, 4.25 million tons of garbage, or enough to fill 11 Tokyo baseball domes, were dumped in the sea at this point. Landfill garbage makes up 21 percent of all nonburnable garbage in Tokyo. Even the ashes of the burned garbage are often buried in landfills.

However, after two decades of dumping, the site was predicted to reach capacity by the autumn of 1997. After that, city officials intend to expand their use of garbage incinerators.¹

Japan's choice to use the sea for its garbage dump is not without health consequences. Hundreds died and thousands were crippled when they were poisoned by seafood contaminated with mercury from sludge dumped by chemical makers into Minamata Bay during the 1950s and 1960s.²

So what does this have to do with the history of Tokyo Disneyland? Tokyo Disneyland was built on land that used to be just open bay.

Method 2: Garbage Incineration (Burnable waste)

Japan is an island country with a limited amount of land available for burying its garbage. As a result, Japan has turned to burning its garbage as a way to reduce the amount of waste the country has to bury (the burned ash must still be disposed of).

In October 1996, the International Solid Waste Association held its seventh International Congress and Exhibition in Yokohama, Japan. Sachiko Naito, chairman of the host committee for the Congress, said, "Japan has taken a stance to incinerate as much burnable garbage as possible. The Health and Welfare Ministry has said that 95 percent of garbage can be disposed of by incinerating."³

This stance toward incineration has led to the transfer of waste disposal responsibilities to each of the twenty-three Tokyo wards. There were thirteen incinerators in Tokyo in 1997 with an additional six planned for completion by fiscal 1999. Even the densely populated Chiyoda and Shibuya wards will receive an incinerator.⁴

¹ Sasamoto, Hiromi. "Garbage, Garbage Everywhere," *The Daily Yomiuri*, January 1, 1997.

² "Japan Dumps 43 Million Tons of Waste in Sea," *United Press International*, November 3, 1996.

³ "Naito Emphasizes Cooperation in Battle Against Garbage Problems," *Mainichi Daily News*, October 27, 1996.

⁴ Sasamoto, Hiromi. "Garbage, Garbage Everywhere," *The Daily Yomiuri*, January 1, 1997.

handout #2

Although the incinerators will reduce the amount of waste that is buried in Tokyo Bay, there is public opposition to the plan because of the additional air pollution these incinerators will generate. Take for example the issue of dioxins. These highly toxic, carcinogenic chemicals are produced by the incineration of plastics. In July 1996, 72 incinerators surpassed the government's limits for safe levels of dioxins.⁵

Method 3: Recycling (Recyclable waste)

In 1993, about 40 percent of the municipal governments participated in recycling efforts. These efforts focused mainly on recycling cans and glass bottles.⁶ One of the reasons the recycling of cans is so successful is that there are clear markets for the recyclable material.

Cans are made of either steel or aluminum. Steel scrap is reclaimed mainly by electric steel makers and is used to produce building materials such as steel bars and sections. More than half of the aluminum scrap is used to make new cans, since the material is little different from the original aluminum. Also, recycling of aluminum saves energy. Recycling of the metal uses only 3 percent of the energy consumed in the production of new metal. This is especially important in Japan, where there is a heavy dependence on foreign oil. Japan's 1995 recycling ratio for steel cans led global rankings for the fourth consecutive year at 73.8 percent. Japan's 1995 recycling ratio of 65.7 percent for aluminum cans surpassed the U.S. figure of 62.2 percent for the first time.⁷

Other efforts at recycling have been less successful. Items such as Styrofoam, plastic, and paper often make up the packaging of a product. So if a person buys a new radio, the box along with the other packaging becomes garbage when the person throws it away. The Japanese Health Ministry estimates that 50 to 60 percent of flammable waste and 70 percent of non-flammable waste is product packaging. However, in 1993 only 2 percent of Styrofoam trays were recycled.⁸ A 1996 report stated that of 8 million tons of plastic generated each year, only about 2 million tons are recycled. The rest is either incinerated or buried.⁹

In response to the manufacturers' lack of attention to product packaging waste, the Tokyo government enacted the 1977 Receptacles and Wrappings and Recycle Law. This law obligates manufacturers and marketing companies to bear financial responsibility for the recycling of packaging waste collected by the municipal government. This cost will eventually be passed on to consumers in the form of higher retail prices. Designers hope that the desire to keep retail prices low will encourage companies to reduce the waste generated and will encourage the public to recycle more of their garbage.¹⁰

Alternatives: Power Generation and Home Composting

The following two examples are ways people in and around Tokyo are exploring alternatives to their garbage management problems.

⁵ "Dioxin Emission Levels Top Limit at 72 Facilities," Kyodo News Service, Japan Economic Newswire, April 11, 1997.

⁶ Murakami, Asako, "Ministries Battle over Rubbish," *Japan Times Weekly International Edition*, May 1, 1995-May 7, 1995.

⁷ "Used Can Recycling Progressing Steadily in Japan," *Asia Pulse*, April 17, 1997.

⁸ Murakami.

⁹ "NKK Fired up About Plastics Recycling," *The Nikkei Weekly*, October 28, 1996.

¹⁰ "Editorial Tackle Trash Troubles with 'Tokyo Rule,'" *The Daily Yomiuri*, August 13, 1996.

Power Generation

In Saitama Prefecture, near Tokyo, stands a power plant that runs on garbage. Its name alone is a clue to the philosophy that created the plant. It's called REUSE. Every month, the plant burns 20,000 tons of garbage from the 810,000 people living in six surrounding communities. It produces 6 million kilowatt hours (kwh) of electricity per month and has enough energy left over from plant operations to sell 2 million kwh of electricity to Tokyo Electric Power Co. (TEPCO). In over two years, the plant earned 360 million yen in sales.

The plant burns 99 percent of the garbage collected from its main city, Koshigaya, with only 1 percent sent to the city landfills. The ash is also recycled. It is melted into slag that is mixed with cement to make road pavement.

The heat is also used to warm water that is pumped to a hospital, gym, ballpark, and a building for the physically disabled. There are plans to expand this warm water supply to a nursing home, swimming pool, tropical botanical garden, and a farm.

The building itself is designed to last 60 to 100 years, so that it won't wear out and need to be replaced, adding to the area's waste.¹¹

Home Composting

Kitchen waste such as food is biodegradable. This means that the food can be decomposed by bacteria to form fertilizer (composting). In the United States, some people throw food scraps on a compost pile in the backyard. The bacteria naturally present in the air eventually break the food waste down into fertilizer. The only maintenance needed is to mix the compost pile every week or so.

In space-poor Tokyo, however, residents must rely on machines that fit in the kitchen to do the same thing. Because the fertilizer doesn't need to be buried or burned, the kitchen waste does not need to be managed by the traditional methods. A considerable amount of waste could be eliminated through composting because of Japan's relatively high percentage by weight of kitchen waste to overall domestic refuse.

There are a few barriers to the acceptance of composting by the public. The first is cost. The machines cost 100,000 yen to purchase. Some local governments offer a 30,000-yen subsidy, but this does not cover the entire cost.

The second barrier is the public's lack of awareness of this method as an option. Home composting machine manufacturers say that when they set up booths at recycling fairs, people just pass right by.

The last barrier is that Japan does not have much land to use the fertilizer on. So cooperation with farmers is necessary to utilize the final product.

However, the value of composting can be seen from Tokyo's Kita Ward, which reduced school lunch waste by 70 percent using decomposers. The ward found farmers in nearby Gumma Prefecture who would use the fertilizer. The ward residents even have a chance to buy the vegetables grown by the farmers.¹²

¹¹ Torii, Masashi, "Plant Energizes Waste Disposal," *The Daily Yomiuri*, March 8, 1997.

¹² Hanna, Junko, "Smelly Business: Recycling Kitchen Waste," *The Daily Yomiuri*, January 25, 1997.

handout #3

MANAGEMENT METHOD SORTING CHART

Method	Type of Waste	Advantages	Disadvantages	Incentives to Use

GROUP PAPER PLANNING SHEET

Group Members
Topic
Research Sources (e.g., library, visit to site, personal interview)
Questions to Ask (e.g., How much does this method cost the city each year?)
Group Member Responsibilities

URBANIZATION IN ASIA: KEY ACTORS—THEIR ROLES AND CONCERNS

Organizing Questions

- What significance does urbanization have for the environment of Asia?
- What are some of the roles and concerns of key actors involved with environmental issues?

Introduction

"Urbanization in Asia represents one of the most important demographic and social phenomena of this century and facilitates economic growth. However, there is need to manage urban growth in an environmentally sound manner if the benefits of economic growth are not to be overwhelmed by the costs of environmental degradation. The problems of pollution and environmental degradation demand concerted action and huge investments in improving water quality, sewerage and sanitation, solid waste management, and air quality." (Brandon and Ramankutty, *Toward an Environmental Strategy for Asia*, p. 62)

Part 1 of this lesson explores current trends in urbanization in Asia. Students consider positive and negative environmental impacts of urbanization.

In part 2 of the lesson, students are introduced to the notion that the nature of urban environmental problems is determined in large part by the interaction of numerous public, private, non-governmental, community, and household actors. Students role-play these various actors and consider strategies for raising awareness of urban environmental management in Jakarta, Indonesia; Karachi, Pakistan; and Seoul, Republic of Korea. Students develop ten-year plans for these megacities and participate in a Megacity Summit.

Objectives

knowledge

- to learn about current trends in urbanization
- to learn about the impact of urbanization on the environment in Asia
- to learn that the nature of urban environmental problems is determined in large part by the interaction of numerous public, private, non-governmental, community, and household actors

lesson five

- to learn about the megacities of Jakarta, Karachi, and Seoul.

attitude

- to appreciate the complex nature of a megacity
- to be sensitive to the multiple issues involving environmental pollution
- to understand how environmental pollution can affect people's lives
- to appreciate various perspectives on the environment

skill

- to work effectively in small groups
- to analyze and synthesize information
- to assume roles of various actors concerned with urban environmental management

Materials

- Handout #1, Urbanization, one per student
- Growth of Urban and Rural Populations in Asia, 1965–2025, transparency
- Asia's 13 Largest Cities, transparency
- Urban Agglomerations with Populations of 10 Million or More, 2015, transparency
- Handout #2, Economic-Environmental Typology of Cities, one per student
- Handout #3, Key Actors—Their Roles and Concerns, ten copies
- Megacity Information Sheet #1, Karachi, Pakistan, one copy
- Megacity Information Sheet #2, Jakarta, Indonesia, one copy
- Megacity Information Sheet #3, Seoul, Republic of Korea, one copy
- Key Actors #1, Environmental Protection Agencies, three copies
- Key Actors #2, Planning Agencies, three copies
- Key Actors #3, Politicians, three copies
- Key Actors #4, Public Works Departments, three copies
- Key Actors #5, Concerned Residents and Community-Based Organizations, three copies
- Key Actors #6, Non-Governmental Organizations, three copies
- Key Actors #7, Private- and Informal-Sector Enterprises, three copies
- Key Actors #8, The News Media, three copies
- Key Actors #9, The Scientific and Engineering Community, three copies

lesson five

Procedure— Part 1: Urbanization

- Key Actors #10, External Support Agencies, three copies

1. Explain to students that in part 1 of this lesson, they will be studying about current trends in urbanization in Asia. In part 2, students, in small groups representing the roles of ten key actors involved with the environment, will examine urbanization in Karachi, Pakistan; Jakarta, Indonesia; and Seoul, Republic of Korea and present ten-year plans for raising awareness of urban environmental management at a Megacity Summit.
2. To begin this lesson, have students discuss urbanization by having them brainstorm what they think the major reasons for this process are in general, what common factors influence this process, and why they think it might be important to study this process. Students should use their own personal experiences with urbanization as a source of information. Distribute Handout #1, Urbanization, and have students work in pairs to discuss the positive and negative environmental impacts of urbanization. Discuss these impacts as a class.
3. Using the transparency, Growth of Urban and Rural Populations in Asia, 1965–2025, have students discuss trends in both East Asia and South Asia. Note that nearly a third of Asia's population currently resides in cities and towns. The World Bank notes that "Urban population growth accounted for 45 percent of total population growth since 1960, tripling the number of city dwellers from 266 million to 840 million. This dramatic demographic shift is continuing unabated—the urban population is expected to triple again to 2.5 billion by 2050, when nearly 60 percent of Asia's population will be living in cities." (Brandon and Ramankutty, *Toward an Environmental Strategy for Asia*, p. 29)
4. To further illustrate the magnitude of urbanization, use the transparency, Asia's 13 Largest Cities, to illustrate the populations of these cities and their average annual growth rate between 1990 and 1995. Note the high average annual growth rates of cities like Bombay, India; Jakarta, Indonesia; Delhi, India; Karachi, Pakistan; and Dhaka, Bangladesh. Next, using the transparency, Urban Agglomerations with Populations of 10 Million or More, 2015, have students compare the populations of the 13 largest cities (1994 statistics) with the projected populations of these cities in 2015.



lesson five

Procedure— Part 2: Key Actors



1. Inform students that in part 2 of this lesson, they will be studying about the impact of urbanization on three megacities in Asia. They will also be introduced to the notion that the nature of urban environmental problems is determined in large part by the interaction of numerous public, private, non-governmental, community, and household actors. Students will role-play these various actors and consider strategies for raising awareness of urban environmental management in Karachi, Pakistan; Jakarta, Indonesia; and Seoul, Republic of Korea. Students will develop ten-year plans for these megacities and participate in a Megacity Summit. Divide students into three groups representing these three megacities.
2. Distribute copies of Handout #2, Economic-Environmental Typology of Cities; Handout #3, Key Actors—Their Roles and Concerns; one of the three Megacity Information Sheets #1–3; and copies of Key Actors #1–10, to each group.

Handout #2, Economic-Environmental Typology of Cities, distinguishes countries based on per capita incomes and summarizes urban environmental problems by these income categories. In this activity, the megacities of Karachi, Pakistan; Jakarta, Indonesia; and Seoul, Republic of Korea represent cities in countries with lower-income, lower-middle-income, and upper-income ranges, respectively. The upper-middle-income range is not represented by a megacity in this lesson because the World Bank lists Malaysia as the only Asian country in the upper-middle-income range, and Malaysia does not have a city with a population of 10 million or more, either currently or projected by the year 2000.

Point out that the nature of urban environmental problems is determined in large part by the interaction of numerous public, private, non-governmental, community, and household actors. Some of the most influential actors and their respective limitations (or strengths) are listed on Handout #3, Key Actors—Their Roles and Concerns.

Each group should assign one student to one of the Key Actors #1–10. If there are more than ten students in each group, ask some students to work in pairs.

Allow students a class period to work on their ten-year plans. Each group should select summit representatives to present a twenty-minute summary of the ten-year plan.

Megacity Summit

1. Once the ten-year plans have been developed, begin the Megacity Summit by welcoming the representatives from Karachi, Jakarta, and Seoul.

lesson five



2. Have student representatives from each megacity present its ten-year plan. Allow each group approximately fifteen minutes for this presentation and five minutes to address questions from the other two groups.
3. Debrief these presentations by asking the following questions:
 - What are some positive and negative environmental impacts of urbanization in the three megacities?
 - What are some generalizations one can make between urban environmental problems in lower-income, lower-middle-income, upper-middle-income, and upper-income countries? How is this evident in the megacities of Karachi, Jakarta, and Seoul?
 - In what ways might the interaction between key actors dealing with urban environmental problems become conflictual? Give examples of this from each megacity group.

Enrichment Activities

Activity #1: Urbanization in the United States

- Research the number of cities in the United States with more than 1 million inhabitants. How many megacities are there in the United States? What are some of the negative environmental impacts of these cities?
- Have students research the four environmental problems (water pollution, air pollution, solid waste management, inappropriate land use) described in this lesson in the city where they live or go to school.

Activity #2: Lyrics for a Song

- As a class or in separate groups, have students compose lyrics for a song on the effects of urbanization on the environment. Ask them to share their impressions, concerns, thoughts for solutions, etc.

Activity #3: Advertisement

- Design an advertisement that focuses on the effects of urbanization on water pollution, air pollution, solid waste management, or inappropriate land use.

Activity #4: Contacting embassies, consulate offices

- Write to an embassy or consulate office of one of the countries with a megacity in Asia. Ask for information about what the government is doing to deal with environmental issues affecting its megacities.

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lesson five

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URBANIZATION

After reading the following handout, discuss the positive and negative environmental impacts of urbanization.

Rapid urbanization, one of the most important demographic and social changes of the century, has both positive and negative environmental impacts. In Asia, eighty-seven cities have more than 1 million inhabitants; of these cities thirty-eight are in China and twenty-three in India. By 2005 more than half of the population in East Asia will live in urban areas. In South Asia the urban population will overtake the rural population by 2025. The negative environmental impact of cities comes from the high levels of pollution they engender. The positive impacts—which need to be more fully realized—are that pollution is more concentrated and can potentially be addressed more cost-effectively and that pressure on rural lands is reduced to the extent that urban growth reduces rural population growth.

Urban population is caused by high population densities, rising urban income and consumption levels, and large industrial concentrations. Infrastructure and services are unable to keep up with these trends. Local governments lack the capacity to collect and dispose of municipal sewage and solid wastes, or to control emissions and toxic wastes. The

concentration of wastes overwhelms the assimilative capacity of natural ecosystems. Human health is threatened by the highly concentrated discharges of pollutants in urban areas.

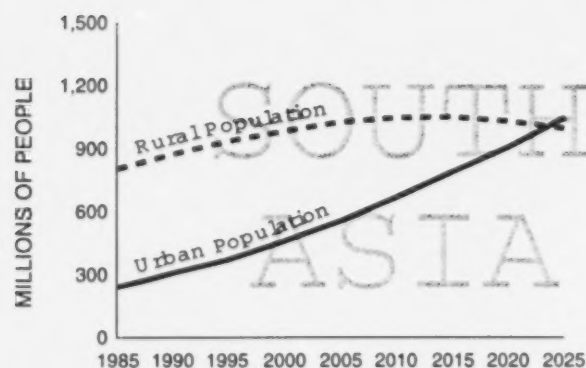
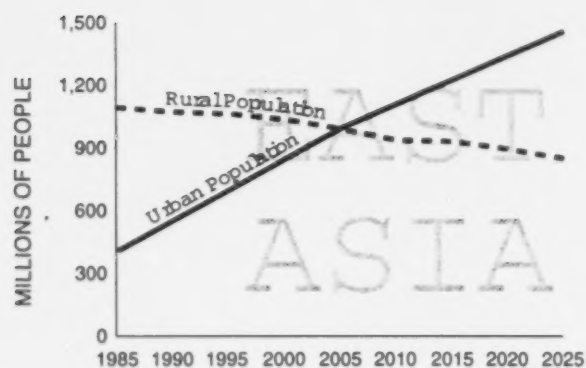
The cost to Asian economies of urban environmental degradation has not been calculated, but initial estimates show that the environmental costs of air and water pollution in Jakarta and Bangkok exceed \$1 billion and \$2 billion per year, respectively. Costs in Asia's other large cities are comparable. Furthermore, these costs are rising as safety thresholds for a large number of pollutants and toxics are exceeded in increasingly large geographic areas. These costs would be 10 to 40 percent higher if vehicle costs and the value of time lost in traffic congestion were included.

In general, four environmental problems need to be addressed in Asian cities: water pollution, air pollution, solid waste management, and inappropriate land use. Of the four, water and air pollution issues (including congestion) will require the greatest investment expenditure.

Source: Brandon and Ramankutty, *Toward an Environmental Strategy for Asia*, pp. 5–6.

transparency

GROWTH OF URBAN AND RURAL POPULATIONS IN ASIA, 1965-2025



Source: *World Urbanization Prospects 1990* (New York: United Nations, 1990).

ASIA'S 13 LARGEST CITIES

Cities	Population (millions)	Average Annual Growth Rate, 1990-95 (%)
Tokyo, Japan	26.8	1.41
Bombay, India	15.1	4.22
Shanghai, China	15.1	2.29
Beijing, China	12.4	2.57
Calcutta, India	11.7	1.67
Seoul, Republic of Korea	11.6	1.95
Jakarta, Indonesia	11.5	4.35
Tianjin, China	10.7	2.88
Osaka, Japan	10.6	0.23
Delhi, India	9.9	3.80
Karachi, Pakistan	9.9	4.27
Metro Manila, Philippines	9.3	3.05
Dhaka, Bangladesh	7.8	5.74

Source: *World Urbanization Prospects: The 1994 Revision* (New York: United Nations, Population Division, 1995).

transparency

URBAN AGGLOMERATIONS WITH POPULATIONS OF 10 MILLION OR MORE, 2015

Cities	Millions of People
Tokyo, Japan	28.7
Bombay, India	27.4
Lagos, Nigeria	24.4
Shanghai, China	23.4
Jakarta, Indonesia	21.2
Sao Paulo, Brazil	20.8
Karachi, Pakistan	20.6
Beijing, China	19.4
Dhaka, Bangladesh	19.0
Mexico City, Mexico	18.8
New York City, U.S.A.	17.6
Calcutta, India	17.6
Delhi, India	17.6
Tianjin, China	17.0
Manila, Philippines	14.7
Cairo, Egypt	14.5
Los Angeles, U.S.A.	14.3
Seoul, Republic of Korea	13.1
Buenos Aires, Argentina	12.4
Istanbul, Turkey	12.3
Rio de Janeiro, Brazil	11.6
Lahore, Pakistan	10.8
Hyderabad, Pakistan	10.7
Osaka, Japan	10.6
Bangkok, Thailand	10.6
Lima, Peru	10.5
Teheran, Islamic Republic of Iran	10.2

Source: *World Urbanization Prospects: The 1994 Revision* (New York: United Nations, Population Division, 1995).

ECONOMIC-ENVIRONMENTAL TYPOLOGY OF CITIES

Urban environmental problems	Lower-income countries (less than \$650 per capita)	Lower-middle-income countries (\$650–\$2500 per capita)	Upper-middle-income countries (\$2500–\$6500 per capita)	Upper-income countries (more than \$6500 per capita)
<i>Access to basic services</i> • Water supply and sanitation • Drainage • Solid waste collection	Low coverage and poor quality, especially for urban poor Low coverage; frequent flooding Low coverage, especially for urban poor	Low access for urban poor Inadequate; frequent flooding Inadequate	Generally acceptable water supply, reasonable sewerage Reasonable Reasonable	Good; concern with trace substances Good Good
<i>Pollution</i> • Water pollution • Air pollution • Solid waste disposal • Hazardous waste management	Problems with inadequate sanitation and raw domestic sewage Severe problems in some cities using soft coal; indoor exposure for poor Open dumping, mixed wastes Non-existent capacity	Severe problems from untreated municipal discharges Severe problems in many cities from soft coal use and/or vehicle emissions Mostly uncontrolled landfills, mixed wastes Severe problems, little capacity	Severe problems from poorly treated municipal and industrial discharges Severe problems in many cities from soft coal use and/or vehicle emissions Semi-controlled landfills Severe problems, growing capacity	High levels of treatment; concern with amenity values and toxic substances Problems in some cities from vehicle emissions; health priority Controlled landfills, incineration, resource recovery Moving from remediation to prevention
<i>Resource losses</i> • Land management	Uncontrolled land development and use; pressure from squatter settlements	Ineffective land use controls	Some environmental zoning practiced	Environmental zoning commonplace
<i>Environmental hazards</i> • Natural and man-made hazards	Recurrent disasters with severe damage and loss of life	Recurrent disasters with damage and loss of life	High risk from industrial disasters	Good emergency response capacity

Source: Carl Bartone et al., *Toward Environmental Strategies for Cities* (Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank, 1994), p. 19.

handout #3

KEY ACTORS—THEIR ROLES AND CONCERNS

The nature of urban environmental problems is determined in large part by the interaction of numerous public, private, non-governmental, community, and household actors. Some of the most influential actors and their respective limitations (or strengths) include:

Key Actors	Their Roles and Concerns
Environmental protection agencies	Environmental protection agencies are responsible for setting environmental regulations and standards and for monitoring and enforcement.
Planning agencies	Planning agencies are responsible for environmental analysis and information and applying this to local development planning.
Politicians	Politicians have the responsibility of representing the needs of the people. They often have the task of allocating resources for environmental purposes.
Public works departments	Public works departments have the task of constructing schools, highways, docks, bridges, and other infrastructure projects for public use and enjoyment.
Concerned residents and community-based organizations	Concerned residents and community-based organizations have members and leaders who are acutely aware of the impacts of environmental problems at the household and neighborhood levels.
Non-governmental organizations (NGOs)	Non-governmental organizations (NGOs) can be effective agents for building local awareness, for mobilizing community action, and for voicing local concerns.
Private- and informal-sector enterprises	Private- and informal-sector enterprises are generally concerned about the constraints placed on their businesses by environmental regulations and the costs such rules incur, particularly when enforcement is lax or inconsistent. Members of the business community seldom wish to be perceived as environmental villains and should be co-opted into the search for solutions.
The news media	The news media can voice concern for the environment and report on those who are affected by environmental conditions.
The scientific and engineering community	The scientific and engineering community can play a pioneering role in shaping the environmental agenda.
External support agencies	External support agencies are a key source of funding for large environmental projects and are important donors of technical assistance and other support.

Source: Carl Bartone et al., *Toward Environmental Strategies for Cities* (Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank, 1994), p. 21.

megacity information sheet #1

KARACHI, PAKISTAN

While reading the following general information about Karachi, note that Karachi's projected population in 2015 is 20.6 million. As a group, consider the environmental impact this may have on the megacity.

Geography

Karachi is located on the coast of the Arabian Sea immediately northwest of the Indus River delta. It is the largest city in Pakistan.

Karachi is situated on the shores of a natural harbor. Moving away from the coast the ground rises gently, forming a large plain to the north and east on which the city is built. Two seasonal rivers run through Karachi: the Malir River, which passes through the eastern part of the city, and the Layari River, which runs through the densely populated northern parts of the city. A few isolated hills and ridges are found to the north and east; the highest point is Manghorpir Hill, which has an elevation of 178 meters.

Demography

Karachi, as the biggest industrial and commercial center in Pakistan, offers considerable employment and business opportunities. Consequently, an increasing number of people migrate from rural areas into the city. The Karachi Development Authority (KDA) has estimated that the annual growth rate of the city is about 6 percent, of which approximately one-half are newcomers from rural communities. In 1990 Karachi had an estimated population of 7.67 million, which is expected to grow to 11.57 million by the year 2000 (UN, 1989).

The city authorities will have to cope with the increasing growth of urban population and provide housing and other civic amenities which are already under heavy strain.

Climate

Karachi's climate can be classified as desert. Pollutants are pushed inland during the southwest monsoon season and are blown out to sea during the north-east monsoons. In the summer, winds are strong, thus resulting in low ambient pollutant concentrations.

Industry

Textiles and footwear are the main manufactured goods produced in Karachi, followed by metal products, food and beverages, paper and printing, wood and furniture, machinery, chemicals and petroleum, leather and rubber, and electrical goods.

Karachi handles the entire seaborne trade of Pakistan and that of neighboring Afghanistan, which is landlocked.

Pakistan is self-sufficient in natural gas and low-sulphur coal, but major imports include crude oil and petroleum products.

Kerosene, firewood, charcoal, and cow dung account for approximately 50 percent of domestic fuel use, mainly in those dwellings where natural gas is not available. It is estimated that 32 percent of dwellings use kerosene for lighting and 66 percent use electricity. Emissions from kerosene stoves are more than twice those from natural gas stoves. An estimated 17,000 dwellings use biomass fuels such as firewood and cow dung.

It is estimated that each year around 2.9 million tons of waste are burned uncontrolled in the open.

Transport

Road transport has become the major mode of transportation for both passengers and goods in Karachi. While in 1980 the number of registered vehicles was around 300,000, this

megacity information sheet #1

number had grown to about 650,000 in 1989. The number of vehicles is projected to rise to about 1.1 million by the year 2000.

Automotive air pollution problems in Karachi are compounded by the high number of old and poorly maintained vehicles.

Karachi also has a large airport and a large naval port, which are additional sources of traffic-related pollutants.

Source: An adaptation of the original text that appeared in World Health Organization and the United Nations Environment Programme, *Urban Air Pollution in Megacities of the World* (Oxford: Blackwell Publishers, 1992), pp. 114, 116. Reproduced with permission.

megacity information sheet #2

JAKARTA, INDONESIA

While reading the following general information about Jakarta, note that Jakarta's projected population in 2015 is 21.2 million. As a group, consider the environmental impact this may have on the megacity.

Geography

Jakarta, the capital of Indonesia, is located in the tropics. The city is on the northwest coast of the island of Java at the mouth of the Ciliwung River.

Demography

The population of Jakarta is growing rapidly. The population was 6.5 million in 1980 and 7.9 million in 1985. To ease the population density problems, Jakarta expanded into 2,620 square kilometers of surrounding land between 1980 and 1985. Much of this land was agricultural land. The population is projected to be 13.23 million by the year 2000, and thus Jakarta's population will have more than doubled between 1980 and 2000.

Climate

Jakarta has a tropical rain forest climate. The annual rainfall is high. The annual mean wind speeds are very low, which indicates a potential for a high air pollutant buildup.

Industry

Jakarta is a major trade, financial, and industrial center. The main industries are breweries, soap and margarine factories, and iron foundries.

Coal, crude oil, and natural gas are important primary energy sources consumed in Indonesia. Total coal production in Indonesia was approximately 6 million tons in 1989-90, and was projected to more than double by 1993-94.

In metropolitan Jakarta a total of approximately 11 million tons of oil and gas were sold during 1987.

Transport

Motor vehicle registrations (e.g., cars, buses, trucks, and motorcycles) totaled about 760,000 in 1980, but grew to 1.12 million in 1983, and to 1.34 million in 1986. In 1987, the most recent year for which information is available, motor vehicle registrations totaled 1.38 million. The number of motor vehicles is growing at a rate of 3-4 percent per annum. Jakarta has no developed mass transit rail system. Public transportation is mainly provided by diesel buses with no emission controls.

Source: An adaptation of the original text that appeared in World Health Organization and the United Nations Environment Programme, *Urban Air Pollution in Megacities of the World* (Oxford: Blackwell Publishers, 1992), p. 107. Reproduced with permission.

megacity information sheet #3

SEOUL, REPUBLIC OF KOREA

While reading the following general information about Seoul, note that Seoul's projected population in 2015 is 13.1 million. As a group, consider the environmental impact this may have on the megacity.

Geography

The capital of the Republic of Korea, Seoul is located on the western side of the Korean Peninsula. The center of Seoul is 30 kilometers inland from the Yellow Sea and is situated on the north side of the Han River, which originates in the hills southeast of the city.

Demography

Almost 25 percent of the people in the Republic of Korea live in Seoul, which had an estimated population of 11.33 million in 1990 (UN, 1989). The Seoul area is one of the most densely populated regions in the world. People have settled in the region because of its status as the center of political and economic decision-making and education, and the area has experienced rapid population growth. Between 1950 and 1990, Seoul's population increased tenfold. It is estimated that Seoul's population will be 12.97 million by the year 2000 (UN, 1989).

Climate

Seoul has a warm summer climate. Winters are cold and dry. Summers are hot and humid.

Industry

The largest proportion of the economically active population is employed in manufacturing. The main products are electrical machinery (electronics), textiles (clothing), chemicals (refining), motor vehicles, and food products. The trade and service industries and construction generate a significant amount of economic activity. Agriculture, forestry, and fishing are also important components, but are more prevalent outside of Seoul.

In conjunction with the increase in population and economic activity, Korean energy consumption has risen sharply. Between 1973 and 1987, consumption almost tripled, with industrial and domestic/commercial activities accounting for a majority of the energy used.

Transport

Seoul is connected to other principal cities by a relatively modern transport network of motorways. The number of motor vehicles in the Republic of Korea has increased very rapidly over the past 30 years. There was nearly a 100-fold increase from 1960 (29,000) to 1989 (2,660,000). Seoul, which has about 40 percent of the registered vehicles in the Republic of Korea, has problems of traffic congestion and air pollution related to motor vehicles. Rail has been a popular form of transport, but its use remained steady from 1986 to 1988.

Source: An adaptation of the original text that appeared in World Health Organization and the United Nations Environment Programme, *Urban Air Pollution in Megacities of the World* (Oxford: Blackwell Publishers, 1992), pp. 195, 197. Reproduced with permission.

ENVIRONMENTAL PROTECTION AGENCIES



Environmental protection agencies are responsible for setting environmental regulations and standards and for monitoring and enforcement.

Your Task

As leaders of key environmental protection agencies in your country, read and discuss the Megacity Information Sheet, taking special note of the megacity's environmental impact. Consider your megacity's current and projected population in 2015. This growth will put a tremendous strain on the environment. What can you do as leaders of key environmental protection agencies to raise awareness of this issue? Some strategies are listed below. Your task is to develop a ten-year plan to share at an upcoming megacity summit. Keep in mind that some critics of environmental protection agencies say that too often environmental protection agencies are relatively weak bodies with only coordination functions. You want to maintain current levels of funding, so you also need to prove these critics wrong.

Your ten-year plan can take any form, but make sure that your presentation is limited to 5 minutes.

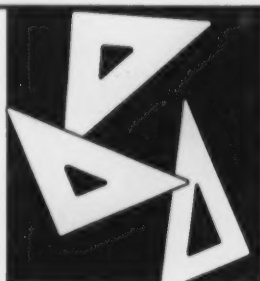
Strategies for Raising Awareness

Raising awareness of urban environmental management can be formal (for example, school courses on ecology and urban life) or informal (pollution monitoring by neighborhood groups). Options that have been used in different cities include:

Strategy	Purpose
Formal community education	To educate the public about the linkages between urban sanitation and public health
Ecology courses	To educate students as part of the formal school curriculum
Resource conservation campaigns	To promote the efficient use and reuse of fuels, water, paper, metals, glass, plastic, and other resources
Targeted environmental education	To inform community leaders, politicians, city officials, and others
Regular, publicized evaluations and awards	To recognize and encourage environmental improvement and urban environmental quality
Media campaigns	To research and publicize particular issues of community concern
Regular information on environmental quality	To monitor environmental quality (e.g., air pollution reports in the news media)

key actors #2

PLANNING AGENCIES



Planning agencies are responsible for environmental analysis and information and applying this to local development planning.

Your Task

As leaders of key planning agencies in your country, read and discuss the Megacity Information Sheet, taking special note of the megacity's environmental impact. Consider your megacity's current and projected population in 2015. This growth will put a tremendous strain on the environment. What can you do as leaders of key environmental protection agencies to raise awareness of this issue? Some strategies are listed below. Your task is to develop a ten-year plan to share at an upcoming megacity summit. Keep in mind that some critics of planning agencies say that too often staff are unfamiliar with environmental analysis and information and how to apply it to local development planning. You want to maintain current levels of funding, so you also need to prove these critics wrong.

Your ten-year plan can take any form, but make sure that your presentation is limited to five minutes.

Strategies for Raising Awareness

Raising awareness of urban environmental management can be formal (for example, school courses on ecology and urban life) or informal (such as monitoring of pollution by neighborhood groups). Options that have been used in different cities include:

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Regular information on environmental quality	To monitor environmental quality (e.g., air pollution reports in the news media)

POLITICIANS



Politicians have the responsibility of representing the needs of the people. They often have the task of allocating resources for environmental purposes.

Your Task

As politicians in your country, read and discuss the Megacity Information Sheet, taking special note of the megacity's environmental impact. Consider your megacity's current and projected population in 2015. This growth will put a tremendous strain on the environment. What can you do as politicians to raise awareness of this issue? Some strategies are listed below. Your task is to develop a ten-year plan to share at an upcoming megacity summit. Keep in mind that some critics of politicians, particularly at the local level, say that too often they are preoccupied with maintaining their power and influence and take a short-term view when allocating resources. Keep this in mind as you want to be reelected by the people after your current terms have expired.

Your ten-year plan can take any form, but make sure that your presentation is limited to five minutes.

Strategies for Raising Awareness

Raising awareness of urban environmental management can be formal (for example, school courses on ecology and urban life) or informal (such as monitoring of pollution by neighborhood groups). Options that have been used in different cities include:

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Media campaigns	To research and publicize particular issues of community concern
Regular information on environmental quality	To monitor environmental quality (e.g., air pollution reports in the news media)

key actors #4

PUBLIC WORKS DEPARTMENTS



Public works departments have the task of constructing schools, highways, docks, bridges, and other infrastructure projects for public use or enjoyment.

Your Task

As leaders of public works departments in your country, read and discuss the Megacity Information Sheet, taking special note of the megacity's environmental impact. Consider your megacity's current and projected population in 2015. This growth will put a tremendous strain on the environment. What can you do as leaders of public works departments to raise awareness of this issue? Some strategies are listed below. Your task is to develop a ten-year plan to share at an upcoming megacity summit. Keep in mind that some critics of public works departments say that public works officials often promote infrastructure and development projects that lack basic environmental considerations. You want to maintain current levels of government funding, so you also need to prove these critics wrong.

Your ten-year plan can take any form, but make sure that your presentation is limited to five minutes.

Strategies for Raising Awareness

Raising awareness of urban environmental management can be formal (for example, school courses on ecology and urban life) or informal (such as monitoring of pollution by neighborhood groups). Options that have been used in different cities include:

Strategy	Purpose
Formal community education	To educate the public about the linkages between urban sanitation and public health
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Media campaigns	To research and publicize particular issues of community concern
Regular information on environmental quality	To monitor environmental quality (e.g., air pollution reports in the news media)

CONCERNED RESIDENTS AND COMMUNITY-BASED ORGANIZATIONS



Concerned residents and community-based organizations have members and leaders who are acutely aware of the impacts of environmental problems at the household and neighborhood levels.

Your Task

As concerned residents and leaders of community-based organizations in your country, read and discuss the Megacity Information Sheet, taking special note of the megacity's environmental impact. Consider your megacity's current and projected population in 2015. This growth will put a tremendous strain on the environment. What can you do as concerned residents and leaders of community-based organizations to raise awareness of this issue? Some strategies are listed below. Your task is to develop a ten-year plan to share at an upcoming megacity summit. Keep in mind that often concerned residents and leaders of community-based organizations have few opportunities to participate in the preparation of urban infrastructure or industrial projects that affect them.

Your ten-year plan can take any form, but make sure that your presentation is limited to five minutes.

Strategies for Raising Awareness

Raising awareness of urban environmental management can be formal (for example, school courses on ecology and urban life) or informal (such as monitoring of pollution by neighborhood groups). Options that have been used in different cities include:

Strategy	Purpose
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Media campaigns	To research and publicize particular issues of community concern
Regular information on environmental quality	To monitor environmental quality (e.g., air pollution reports in the news media)

key actors #6

NON-GOVERNMENTAL ORGANIZATIONS



Non-governmental organizations (NGOs) can be effective agents for building local awareness, for mobilizing community action, and for voicing local concerns.

Your Task

As leaders of non-governmental organizations (NGOs) in your country, read and discuss the Megacity Information Sheet, taking special note of the megacity's environmental impact. Consider your megacity's current and projected population in 2015. This growth will put a tremendous strain on the environment. What can you do as leaders of NGOs to raise awareness of this issue? Some strategies are listed below. Your task is to develop a ten-year plan to share at an upcoming megacity summit. Keep in mind that some critics of environmental NGOs say that these groups focus almost exclusively on "green" and global issues and pay insufficient attention to "brown" issues. "Brown" issues refer to the critical and most immediate problems facing cities in developing countries such as the health impacts of urban pollution that derive from inadequate water, sanitation, drainage and solid-waste services, poor urban and industrial-waste management, and air pollution. "Green" issues refer to problems such as the depletion of water and forest resources, the degradation of environmentally fragile lands, and other global issues.

Your ten-year plan can take any form, but make sure that your presentation is limited to five minutes.

Strategies for Raising Awareness

Raising awareness of urban environmental management can be formal (for example, school courses on ecology and urban life) or informal (such as monitoring of pollution by neighborhood groups). Options that have been used in different cities include:

Strategy	Purpose
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Media campaigns	To research and publicize particular issues of community concern
Regular information on environmental quality	To monitor environmental quality (e.g., air pollution reports in the news media)

PRIVATE- AND INFORMAL-SECTOR ENTERPRISES



Private- and informal-sector enterprises are generally concerned about the constraints placed on their businesses by environmental regulations and the costs such rules incur, particularly when enforcement is lax or inconsistent.

Your Task

As leaders of private- and informal-sector enterprises in your country, read and discuss the Megacity Information Sheet, taking special note of the megacity's environmental impact. Consider your megacity's current and projected population in 2015. This will put a tremendous strain on the environment. What can you do as leaders of private- and informal-sector enterprises to raise awareness of this issue? Some strategies are listed below. Your task is to develop a ten-year plan to share at an upcoming megacity summit. Keep in mind that members of the business community are sometimes perceived as environmental villains, and you want to help dispel this notion.

Your ten-year plan can take any form, but make sure that your presentation is limited to five minutes.

Strategies for Raising Awareness

Raising awareness of urban environmental management can be formal (for example, school courses on ecology and urban life) or informal (such as monitoring of pollution by neighborhood groups). Options that have been used in different cities include:

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Media campaigns	To research and publicize particular issues of community concern
Regular information on environmental quality	To monitor environmental quality (e.g., air pollution reports in the news media)

key actors #8

THE NEWS MEDIA



The news media can voice concern for the environment and report on those who are affected by environmental conditions.

Your Task

As representatives of the news media in your country, read and discuss the Megacity Information Sheet, taking special note of the megacity's environmental impact. Consider your megacity's current and projected population in 2015. This growth will put a tremendous strain on the environment. What can you do as representatives of the news media to raise awareness of this issue? Some strategies are listed below. Your task is to develop a ten-year plan to share at an upcoming megacity summit. Keep in mind that some critics of the news media say that this role can be negative if the tendency is to sensationalize the environmental topics rather than focus on real local priorities.

Your ten-year plan can take any form, but make sure that your presentation is limited to five minutes.

Strategies for Raising Awareness

Raising awareness of urban environmental management can be formal (for example, school courses on ecology and urban life) or informal (such as monitoring of pollution by neighborhood groups). Options that have been used in different cities include:

Strategy	Purpose
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Regular, publicized evaluations and awards	To recognize and encourage environmental improvement and urban environmental quality
Media campaigns	To research and publicize particular issues of community concern
Regular information on environmental quality	To monitor environmental quality (e.g., air pollution reports in the news media)

THE SCIENTIFIC AND ENGINEERING COMMUNITY



The scientific and engineering community can play a pioneering role in shaping the environmental agenda.

Your Task

As leaders of the scientific and engineering community in your country, read and discuss the Megacity Information Sheet, taking special note of the megacity's environmental impact. Consider your megacity's current and projected population in 2015. This growth will put a tremendous strain on the environment. What can you do as leaders of the scientific and engineering community to raise awareness of this issue? Some strategies are listed below. Your task is to develop a ten-year plan to share at an upcoming megacity summit. Keep in mind that some critics of the scientific and engineering community say that it often sets its agenda for environmental research and monitoring on the basis of its own scientific interests without giving due thought to the needs of vulnerable populations. Also, because valuable information on the environment often is published in scientific journals in technical language, the scientific community should ensure that data are communicated in a less scholarly form to wider audiences, including the media and environmental policy makers, planners, and managers.

Your ten-year plan can take any form, but make sure that your presentation is limited to five minutes.

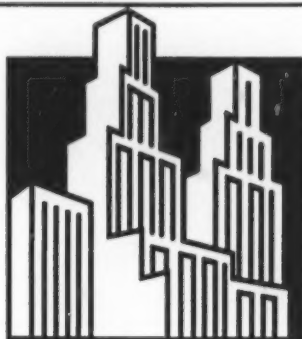
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Regular, publicized evaluations and awards	To recognize and encourage environmental improvement and urban environmental quality
Media campaigns	To research and publicize particular issues of community concern
Regular information on environmental quality	To monitor environmental quality (e.g., air pollution reports in the news media)

key actors #10

EXTERNAL SUPPORT AGENCIES



External support agencies are a key source of funding for large environmental projects and are important donors of technical assistance and other support.

Your Task

As members of external support agencies in your country, read and discuss the Megacity Information Sheet, taking special note of the megacity's environmental impact. Consider your megacity's current and projected population in 2015. This growth will put a tremendous strain on the environment. What can you do as members of external support agencies to raise awareness of this issue? Some strategies are listed below. Your task is to develop a ten-year plan to share at an upcoming megacity summit. Some critics of external support agencies have noted that in some instances these agencies may give high priority to the environment and to poverty reduction, but many have only recently recognized the critical importance of urban areas to overall national development. You want to help prove these critics wrong.

Your ten-year plan can take any form, but make sure that your presentation is limited to five minutes.

Strategies for Raising Awareness

Raising awareness of urban environmental management can be formal (for example, school courses on ecology and urban life) or informal (such as monitoring of pollution by neighborhood groups). Options that have been used in different cities include:

Strategy	Purpose
Formal community education	To educate the public about the linkages between urban sanitation and public health
Ecology courses	To educate students as part of the formal school curriculum
Resource conservation campaigns	To promote the efficient use and reuse of fuels, water, paper, metals, glass, plastic, and other resources
Targeted environmental education	To inform community leaders, politicians, city officials, and others
Regular, publicized evaluations and awards	To recognize and encourage environmental improvement and urban environmental quality
Media campaigns	To research and publicize particular issues of community concern
Regular information on environmental quality	To monitor environmental quality (e.g., air pollution reports in the news media)

SUSTAINABILITY OF MEGACITIES

Organizing Questions

- What are the major environmental problems facing Asia?
- What are the major underlying causes of environmental degradation?
- What are some solutions to reducing environmental degradation?

Introduction

"The environment of Asia is one of the greatest development challenges in the world today. The reason is not only the complexity of environmental issues themselves but also the complex linkages between growth, population, poverty, and the environment. Asia has already dramatically shown that economic growth can reduce population growth rates and the incidence of poverty. However, to sustain the recent economic gains, greater priority will need to be given to the development of sound environmental policies and of public and private institutions capable of implementing these policies." (Brandon and Ramankutty, *Toward an Environmental Strategy for Asia*, p. vii)

Lesson 6 examines the sustainability of megacities. The lesson can be taught in isolation of the first five lessons of the curriculum unit, as it offers an overview of megacity trends, concerns about the sustainability of megacities, underlying causes of environmental degradation, suggested actions and priorities, and possible solutions. Important information from these overviews are incorporated into a board game called "Sustainability." Students play this game in small groups while considering the environmental impact of megacities.

Objectives *knowledge*

- to understand trends in the growth of megacities
- to obtain a broad understanding of urbanization
- to see connections between the various aspects of a megacity and environmental concerns
- to understand underlying causes of environmental degradation
- to consider possible solutions to reduce environmental degradation

attitude

lesson six

- to appreciate the complex nature of a megacity
- to approach a subject from many points of view
- to be sensitive to the multiple issues involving environmental pollution
- to understand how environmental pollution can affect people's lives

skill

- to work effectively in small groups
- to summarize a reading passage succinctly and extract its major points
- to analyze and synthesize information
- to see connections between the environment and megacities and be able to articulate them

Materials

- Handout #1, Megacity Trends, one copy for each pair of students
- Handout #2, Areas of Environmental Concern: Water, Air, Waste, and Land Use, one copy for each pair of students
- Handout #3, Underlying Causes of Environmental Degradation, one copy for each pair of students
- Handout #4, Suggested Courses of Action, one copy for each pair of students
- Possible Solutions to Reduce Environmental Degradation, for the teacher
- Sustainability Game Instructions, one copy per group of three or four student pairs
- Sustainability Assessment, for the teacher
- Tape
- dice, one or two per group

The following are located in the appendices:

- Sustainability Game Setup Guide, for the teacher
- Sustainability Game, one copy per group of three or four student pairs
- Environmental IQ Cards, one set of cards per group of three or four student pairs (tape prior to teaching part 2 of this lesson)
- Sustainability Game Score Sheet, one copy for every pair of students

Procedure— Part 1

1. Explain to students that this lesson examines the sustainability of megacities. The lesson has two parts. Part 1 offers an overview of megacity trends, concerns about the sustainability of megacities, areas of environmental concern, underlying causes of environmental degradation, suggested courses of action, and possible solutions to reduce environmental degradation. Important information from these overviews is incorporated into a board game called "Sustainability." In part 2 of the lesson, students play this game in small groups while considering the environmental impact of megacities.



2. Divide the students into pairs. Distribute the following handouts to each of the pairs: Handout #1, Megacity Trends; Handout #2, Areas of Environmental Concern: Water, Air, Waste, and Land Use; Handout #3, Underlying Causes of Environmental Degradation; Handout #4, Suggested Courses of Action. Have student pairs read through their handouts and discuss the issues on each of the handouts. Mention to students that the information provided on these handouts is incorporated in the board game "Sustainability," which follows in part 2 of this lesson. Sections of the board game include "Environmental IQ" questions, and the student pairs will work as a team to answer these questions with the goal of winning the game. Each student in the pair may want to be the primary "expert" on the information contained in two of the four handouts.

Procedure— Part 2

1. With the students in the same pairs as in part 1 of this lesson, divide the class into groups of three or four student pairs. Distribute copies of the following to each group:
 - Sustainability Game Instructions, one copy for each group
 - Sustainability Game, one copy for each group
 - Environmental IQ Cards, one set of cards for each group
 - Sustainability Score Sheet, one copy for every pair of students
2. Allow students a class period to play the game. Each group should refer to the "Sustainability Game Instructions" for directions.

Assessment

Though the students should be encouraged to take turns reading the spaces aloud to one another as they progress through the game, some students may be tempted to skip the reading and only record the points in the space. In an effort to discourage shortcuts, the teacher may want to follow the game with an assessment of the students' grasp of the material presented in the game. Refer to the Sustainability Assessment for sample follow-up questions, which the teacher may ask the students to respond to orally during a group discussion or in writing.

lesson six

Reference Brandon, Carter; and Ramankutty, Ramesh. *Toward an Environmental Strategy for Asia*. Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank, 1993.

MEGACITY TRENDS

A Shift Toward Industry

Asia is currently experiencing a substantial shift in its population. People are moving from rural areas to cities. According to a study by the World Bank, the number of people in Asian cities is expected to triple between 1990 and 2025. Over eighty-seven cities in South and East Asia have populations of over one million people. Of these cities, nine have populations of over 10 million—making them true megacities. Population projections show that Asia may have as many as seventeen megacities by the year 2015.

What is responsible for this growth in urban population? Many factors contribute. A major factor is the continued industrialization of Asian nations. Industries choose sites that make it easier or more cost effective to manufacture their products. People choose to move near the industrial sites for the opportunities and services they feel they offer. Some people move to cities because the traditional work they used to do in their rural villages is no longer needed. Many rural laborers' jobs are now done by machinery. Owning or gaining title to a parcel of land to farm is difficult. Much of the land no longer produces good crops due to poor farming techniques. Many people have been forced to leave the country when the soil and forests have become depleted from overuse. Getting a job in a city may seem like the only route available for some people. Others may migrate to urban areas for the excitement of living in a larger community or the chance to learn new skills or meet new people. For most, however, it is the prospect of better wages and the chance to build a better life that lure them to the city.

In addition to migration, cities experience internal population growth. Even though fertility rates have been declining, they remain above replacement levels in most Asian countries. According to a World Bank study, most Asian women have four children in their lifetimes (China, Indonesia, Korea, Malaysia, and Thailand excepted).

Straining Infrastructure

As a city's population continues to grow, it is difficult for the existing economic systems that provide necessary products and services such as food, water, waste collection, and transportation to keep pace with the demands of the larger population. These added strains on a city's infrastructure may cause serious problems. Not only does the quality of services the city is able to provide diminish as the population increases, but the short-term solutions (or lack of solutions) often damage the surrounding environment. Many large Asian cities are not able to guarantee a safe water source for all of their residents or clean air to breathe. Some cities have no treatment center for raw sewage or other solid waste. For most Asian cities, transportation of both goods and people is slow and unpredictable, and is the leading cause of pollution in the city. Overuse of the

handout #1

natural resources in the area, or using resources and not restoring them, is called environmental degradation. The effects of environmental degradation are real and becoming quite noticeable: increased health costs, higher mortality rates, poorer crop yields, less output in industries that rely on natural resources, land and air pollution, and, of course, loss of wildlife and natural habitats.

Questions of Sustainability

The question facing these rapidly developing cities is how to provide for the needs of their ever-growing populations without further degrading the very environment that enables the population to exist there. In other words, what steps will the Asian nations need to take to ensure a sustainable, ongoing life for their urban populations?

It is important to note that though the concentration of people in cities does negatively impact the environment, there are positive factors involved that may be used to address the very problems produced by those large populations. Because the population is concentrated, many of the goods and services that most people need can be delivered to them for much less effort or expense. Also, the shift in population to the cities has provided some relief to the rural environments. As people continue to leave the country, use of the land resources should become less invasive. Concentrating population in several large cities could relieve much of the rural environmental damage that has been occurring. However, the need to design and implement effective and efficient infrastructure systems that only minimally impact the urban environment has begun to reach a critical level.

Source Brandon, Carter; and Ramankutty, Ramesh. *Toward an Environmental Strategy for Asia*. Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank, 1993.

AREAS OF ENVIRONMENTAL CONCERN: WATER, AIR, WASTE, AND LAND USE

Water Pollution

There are four areas of environmental concern that the people of Asia must tackle in order to sustain large cities: water pollution, air pollution, solid waste management, and inappropriate use of the land. Of these, water pollution is the most prevalent environmental problem in Asia. Most cities have no means to treat water that has been used (sewage). With the rise in demand for water by both residential and commercial users, and no technology in place for cleaning and recycling used water, it is predicted that water pollution may reach a crisis level. In its study of Asian environmental impacts, the World Bank noted, "Water pollution is responsible for substantial mortality and sickness in Asia, particularly among children."

The main source of the pollution comes from residents of the cities. Most of their sewage is dumped untreated into surface water. Companies formed during the rapid industrialization of the cities contribute to water pollution by dumping metals and toxic wastes into the bodies of water that serve as water supplies for cities. Some water pollutants flow downstream from agriculture and mining operations.

Air Pollution

In a study that ranked world cities with the worst air pollution, five Asian cities were at the top of the list—Beijing, Calcutta, Jakarta, New Delhi, and Shenyang. The World Bank study cites lung cancer mortality as four to seven times higher in Chinese cities than in the nation as a whole. In Calcutta, 60 percent of the city residents suffer from respiratory diseases. The national norm is 2.5 percent.

The major cause of the air pollution in Asia is motor vehicles. Though the vehicle/person ratio is relatively low compared to other parts of the world, it is estimated that the ratio will double almost every seven years. The autos manufactured in these countries typically have no pollution controls. Due to the high cost of new cars, many of the cars on the road are old and inefficient. Motorcycles are very popular and do save gas, but the two-stroke engines they use are highly polluting. Diesel fuel, which is less refined than gasoline, is widely used, as are other fuels high in lead and sulfur. In addition, paved roads and traffic management systems have not kept pace with the rapid industrialization, so the stalled vehicles in the resulting traffic jams only further add to the air pollution.

Emissions from industries also contaminate the air, as well as smoke from the coal furnaces people use to heat their homes and businesses. In fact, smoke from commercial and home heating is one of the most prevalent air pollutants in Beijing and other Chinese cities.

handout #2

Solid Waste

The amount of trash individuals accumulate in a day is called the solid waste generated per capita. For most of Asia the amount is very low (less than a pound a day) because most people do not have enough money to purchase many packaged goods. However, even though the individual amount is low, the sheer size of the population in many Asian cities causes the total amount of solid waste generated by a large city to be a growing concern. As urbanization continues, more products will be manufactured, and more consumers will have the purchasing power to buy them, so the generation of solid waste for both commercial and residential units will continue to rise. The World Bank gives as an example the fact that Bombay (Mumbai) produces 1.2 million tons of solid waste per year, whereas Tokyo, with nearly the same population but a more developed infrastructure and marketplace, produces 4.5 million tons.

The majority of solid waste in Asia is disposed of in landfills. Most cities have no program in place for the recycling of materials. As populations have continued to grow, many cities have not been able to keep up with regular trash collection and landfills have been stretched beyond capacity. Most cities do not have the technology to handle the special disposal required for toxic and hazardous waste; as a result, they are dumped together with the domestic waste.

Inappropriate Land Use

The natural physical features of Asian countries vary a great deal, but even so, degradation of the land is a significant problem that all Asian nations have in common. Land that has been inappropriately used often results in soil that has eroded and forests that have been depleted. Erosion of the soil is caused primarily by the thinning of natural vegetation through logging, overgrazing, and collecting fuelwood. When bare soil is exposed, wind and rain carry off the prime soil with the essential nutrients. The fragile 6- to 12-inch crust of soil is very vulnerable. The natural vegetation of a region helps to protect and renew the soil. When the vegetation disappears, the prime soil may too, unless protective measures are taken.

In some Asian countries, deforestation, or the cutting down of forests, has nearly depleted their lumber supply. The World Bank study puts the seriousness of the situation in stark financial terms:

An even more immediate indicator of the impact of deforestation is the estimate of future import requirements by countries that have traditionally been wood exporters. Based on current trends, timber and forest products will cost Asian countries nearly \$20 billion a year by 2000. (p. 26)

These countries had lumber resources in such abundance thirty and forty years ago that they could export to other countries; now they have to pay to have lumber imported.

The growing population has put great pressure on the land resources. Much of the forest loss is due to an effort to convert forest land into open land that can be planted for crops. Where forests aren't being cleared for crops, people are cutting down trees for fuelwood. According to the World Bank, nearly 77 percent of the total wood production in the region is used for fuelwood and charcoal. This figure jumps to 90 percent in poorer countries such as Bangladesh, Cambodia, India, Nepal, Sri Lanka, and Pakistan. Commercial logging also depletes forest reserves. Though renewable logging practices are available, they are not widely used.

In addition to the direct loss of a valuable resource, the deforestation of the land causes many serious and long-term problems. When no lumber is near, rural residents will need to move to find new sources, or may be forced to seek work in the cities. Deforestation causes soil erosion. Without forests around to absorb carbon dioxide, extra carbon is released into the atmosphere where it has been shown to contribute to global warming. Finally, it is possible for forests to be replanted, but certain species of animals may be lost forever once their habitats have been destroyed. How much of the natural habitat of Asia has been lost or degraded by invasive use of the land? A World Bank study sets the figure at nearly 75 percent.

Source Brandon, Carter; and Ramankutty, Ramesh. *Toward an Environmental Strategy for Asia*. Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank, 1993.

handout #3

UNDERLYING CAUSES OF ENVIRONMENTAL DEGRADATION

Asian cities are threatened by inadequate and polluted water supplies, traffic congestion and air pollution, waste disposal problems, and rapidly vanishing natural resources. In order to solve these problems, it may be helpful to look for the underlying causes of them.

Market Failure

Historically, humans have not been very careful about conserving the natural resources on our planet. Part of Asia's environmental problems are the same problems that all countries on earth face. Economic systems across the world fail to consider adequately the cost of conserving and preserving the natural resources used by all the world's population. Different countries have met with various levels of success in dealing with recycling attempts, but overall, the failure to price resources to include the real cost of both using and then restoring the resources has been the greatest contributing factor to the environmental degradation experienced everywhere today. To further compound the problem, many governments use subsidies to support industries. These subsidies actually encourage inefficient use of our resources by artificially lowering the actual price of a resource.

Population

A rapidly growing population puts a great strain on the surrounding resources, especially when a large percentage of the population is poor or available land is limited. When the cost of human labor is undervalued, the poor have few options and limited ways to support themselves. They have little interest in protecting the environment—they seek only to sustain a living.

Rapid Urbanization

According to the World Bank, the number of people in Asia living in cities tripled from 1960 to the early 1990s. The number is expected to triple again to 2.5 billion people by 2025 when approximately 60 percent of the people in Asia will reside in cities. This overwhelming growth rate makes it difficult for local communities to provide for the needs of all their people in a way that does not harm the surrounding environment. Often with rapid growth, cities are forced to resort to short-term, stopgap measures that fix the immediate problem but are costly in terms of future impact. Economic growth spurs urbanization, and yet urbanization attracts still more economic activity to the city. This cycle can expand unchecked until the natural resources needed for the continued growth of the city become depleted.

Environmental Protection Viewed as Unprofitable

Most view the steps taken to ensure renewed environmental resources as expensive and unprofitable—that is, there is no perceived return on the extra investment. Though the results of nonprotective use of resources are more noticeable now than they were just a decade ago, people may still resist recognizing the necessity for more responsible use of the surrounding resources. Prudent policies that promote economic growth but protect the most important source of capital, the natural resources themselves, must be implemented before the resources become depleted.

Source Brandon, Carter; and Ramankutty, Ramesh. *Toward an Environmental Strategy for Asia*. Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank, 1993.

SUGGESTED COURSES OF ACTION

Knowing the problems and the underlying causes, Asia's next challenge will be to create strategies that can provide a sustainable process to accommodate the growing needs of the Asian countries, yet reverse the pollution and environmental degradation trends that threaten the sustainability of the region. Recognizing unsustainable trends in a developing city is much easier than sorting out which areas of concern should become the areas to receive priority action. Governments, with the help of technical and public input, must set the highest standards achievable for environmental quality while still meeting the political and economic needs of the population.

Reform Policies

It is imperative to design cost-effective policies that stimulate and direct the economic growth of a region, yet protect the irreplaceable resources those economic activities are built upon. The World Bank in its environmental study of Asia, stressed the same goal:

Environmentally appropriate policies are not inconsistent with policies that foster growth and trade, but they do attempt to correct the bias of market and policy failures that lead to overexploitation of nonpriced and underpriced environmental resources. (p. 2)

Allowing the market to shape policy is an effective tool that can be used in parallel with a city's growth—not in opposition to it. Full-cost pricing of natural resources, removal of subsidies, taxes on pollution emissions, and market permits would help reduce consumption of resources while providing new money to support cleaner technology and recycling programs. Regulatory policies, such as emission restrictions for industries, vehicle inspections, traffic management, and zoning controls can be very effective in reducing pollutants when used with market-based policies. One type of policy reform goes beyond the government as the regulatory agent and directly involves the public. Examples of these extraregulatory approaches would be requesting public disclosures of industries' pollutant levels, consumer boycotts, and using the court system to hear environmental liability suits. Increasing the local population's awareness of endangering practices and encouraging participation in setting and achieving the desired standards is a new, but potentially powerful tool in the effort to sustain environmentally sound economic growth.

Strengthen Implementation of Policies

No matter how strong and explicit the market-based, regulatory, and extraregulatory policy reforms are, they will only be effective to the degree that the private and public institutions are able to put them into practice. Weak implementation of policy is basically like having no policy. Ideally, the setting, overseeing, and enforcing of policy

decisions should be done at the local level—where those most affected by the policies will be involved in their implementation. However, local government agencies in Asia tend to be weak—lacking staff, skills, equipment, and power. The power base of government needs to be decentralized so that local city government can build the capacity to oversee the vital affairs of its citizens. The key is to involve a broader cross-section of the population in the planning and implementation of policies. Cities need to be able to undertake long-term strategic planning, provide urban services, generate revenue or money to help implement those services, form associations with all who influence environmental quality, and monitor and enforce agreed-upon environmental standards. These abilities will take time to develop, but by pooling available resources and discussing directions and goals, all players will feel they have a stake in the future of the city. Shared responsibility and ownership for both the problems and the successes of the various regions will be crucial; the problems are too extensive for one group alone to be responsible for solving.

Increase Investments

Investing practices that acknowledge the true costs of the materials used in production, whether they be costs of raw materials, partially assembled parts, or human labor, must begin to reshape the economic markets. Through improved access to loans and use of special credits and incentives, the private sector can be attracted to invest in environment-friendly industries like energy conservation, waste minimization, recycling, fuel efficiency, and renewable forestry. Public-sector investments, say for infrastructure improvements, may be required to show appropriate funding for responsible resource use. Recovering the cost of a public project, either by creating a product for sale or providing a paying service, should be considered whenever possible. International cost-sharing should be encouraged for large environmental problems that may cross country borders, such as global warming, pollution of the seas, or loss of wildlife through destroyed habitats. Directing money to the industries that will promote sustainability should be one of the highest financial incentives.

Develop Networks and Improve Technologies

One of the saving factors of the megacity sustainability dilemma can be found in the economic activity that causes the cities to grow. As markets continue to expand, Asian countries are adopting less rigid market policies. This openness in the marketplace is crucial to attract investors to the region. Foreign money is often accompanied by policy expertise and up-to-date technology. As Asian markets become attractive targets for foreign investors, these markets can gain access to a wide range of associations that may help in everything from policy advice and strategic planning to sharing "clean technology." International networking and modeling is one of the most cost-effective routes to acquiring new technology.

handout #4

It is important to remember that the global forces that are driving this unprecedented growth in Asian cities—liberalized markets and relaxed trade regimes—can be a helpful source in making the growth of such cities sustainable. Asian cities must take the initiative and tap the resourcefulness and creativity of their people to align the economic trends with sustainable, environmentally sound growth.

Source Brandon, Carter; and Ramankutty, Ramesh. *Toward an Environmental Strategy for Asia*. Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank, 1993.

POSSIBLE SOLUTIONS TO REDUCE ENVIRONMENTAL DEGRADATION

Water

- adjust prices to reflect full costs of using and renewing water sources
- construct domestic sanitation and sewage systems to handle polluted water
- regulate levels of pollutants that industries may discharge into bodies of water
- penalize offenders (both domestic and industrial) of environmental standards
- inspect and maintain cesspools and septic tanks to prevent leakage
- educate population to conserve water
- provide incentives for the development and use of domestic and industrial technologies that conserve water, especially for crop irrigation
- prevent irreversible damage to water sources by protecting watersheds and requiring safe disposal of toxic waste
- encourage local monitoring and regulating of water resources (decentralize)
- encourage a more structured (commercialized) accounting of water use
- develop water commissions to improve water planning (from conception to maintenance) for new projects
- encourage private investment in and ownership of utility companies

Air

- reduce number of vehicle miles traveled
- require pollution-control devices on automobiles
- design new vehicles to meet emission standards
- reduce the number of diesel-fueled engines
- eliminate dirty fuels (those with high lead and sulfur) for vehicles
- require vehicle emission standards testing
- plan efficient road networks
- improve city planning to reduce miles traveled per capita
- improve traffic management
- encourage alternate forms of transportation (mass transit, carpools, bicycles)
- set clear policy standards for permissible emissions for all industrial pollutants
- develop cleaner industrial technology
- reduce use of firewood and coal for domestic heating and cooking; switch to cleaner fuels

for the teacher

Solid Waste

- elevate waste management to a higher priority in city maintenance
- adjust garbage collection prices to reflect full costs of treating, recycling, and disposing of garbage
- plan efficient, thorough strategies for urban garbage collection
- build facilities to recycle paper, plastics, glass and metals
- educate public about value of recycling materials; initiate recycling programs
- encourage domestic composting of kitchen waste
- educate public to recognize dangers of unrestricted solid-waste dumping
- set, monitor, and enforce environmental standards for domestic and industrial waste dumping
- encourage private companies to own and operate solid waste management companies
- develop the capacity to treat hazardous waste separately from domestic waste
- provide incentives for industries to use environment-friendly packaging of goods

Land

- reform forestry pricing to discourage excessive logging
- promote technical innovations for sustainable forestry
- strengthen regulatory agencies to design, implement, and enforce policy
- provide education programs in land use management
- diversify rural employment
- encourage land tenure
- encourage correct high-yield technologies to reduce land acreage in use
- diversify crops
- initiate zoning laws to prioritize land development strategies
- protect surrounding countryside from encroaching urbanization
- provide incentives for private developers to include features of public interest
- encourage public input and participation in decisions
- initiate management of public and communal land
- develop preservation strategies (both physical and financial) for parks and protected areas (e.g., community planning, direct fundraising, ecotourism)
- encourage high-density housing to relieve land use

Miscellaneous

- encourage active policy dialogue with other countries to share environmental standards and model new technologies

for the teacher

- support countries' efforts to file National Environmental Action Plans
- tie international funding of loans to environmental policy implementation and environmental assessments
- educate citizens about the consequences of overpopulation to help curb population growth
- target the most polluting sectors of all industries as highest priorities
- focus environmental resources on a few critical areas; assess effectiveness of programs

instructions

SUSTAINABILITY GAME

Object of the Game:

The goal is to be the first player to navigate the urbanization route and reach the Day of Reckoning with the highest number of positive points.

Playing the Game:

- Two to six players may play.
- Each player selects a game piece (any small object will suffice, e.g., a coin, paper clip, eraser) and places it on the START space.
- Players roll a die to see who will go first.
- Play continues clockwise from the highest roller.
- The starting player rolls the die and proceeds to move forward the number of spaces shown on the die. In an effort to preserve precious land, more than one player may occupy the same space at the same time.
- Players read the information on the space upon which they land, then record the positive or negative points they have "earned."
- All instructions in the spaces must be followed.
- When a player lands on an Environmental IQ space, the person sitting opposite or across from the player will read the question to the player. The reader then checks to see if the player's response is accurate or acceptable. Three points are awarded for acceptable answers. Negative three points are given for unacceptable answers. All reader's decisions are final.
- As the game progresses, players are urged to keep accurate tallies of their scores in the appropriate columns of the score sheet.
- Players need not roll the exact number to land on the Day of Reckoning.
- The first player to reach the Day of Reckoning receives a 12-point bonus; the second, 6 points; the third, 3 points; later finishers receive no points.
- The game is finished when all players reach the Day of Reckoning.
- The winner is the person who has taken the most environmentally responsible path by "earning" the most positive points.
- For faster play, use a pair of dice instead of just one.

Note: Players who have reached the Day of Reckoning may still be required to exchange places with another player on the board; however, the first person finished still keeps the 12 bonus points.

Start!

Your mission: to continue to improve the standards of living for the citizens of Asia while at the same time avoiding further degradation of the environment.

Fast and dirty → **Clean and green**

Day Of Hockoning

YOU'VE ARRIVED - a newly organized megacities expo! If you and the first new expo held 17 booths (plus 100 booths) for 3 days!

Sustainability Game

Setup guide

137

138

BEST COPY AVAILABLE

score sheet

SUSTAINABILITY GAME

Name: _____

To keep track of the points you accumulate, check a box in the appropriate row each time you land on a space. To make the final tally easier, add the sum of each row in the final column as you proceed through the game.

Positive points

points						tally
1						
1						
1						
1						
1						
2						
2						
2						
2						
2						
3						
3						
3						
3						
3						

Negative points

points						tally
- 1						
- 1						
- 1						
- 1						
- 1						
- 2						
- 2						
- 2						
- 2						
- 2						
- 3						
- 3						
- 3						
- 3						
- 3						

Final Positive Tally: _____

Final Negative Tally: _____

Final Score: _____

BEST COPY AVAILABLE

SUSTAINABILITY ASSESSMENT

In this unit the major environmental problems facing Asia were divided into four areas or sectors. What are these four main problem areas?

(Air pollution, water pollution, solid-waste disposal, and land use.)

List four practices that pollute the environment in countries in Asia today.

(These can be any of the negative spaces from the game board.)

List four solutions that would ease pollution problems in Asia.

(These can be any of the positive spaces from the game board.)

List one practice that causes air pollution in Asia and a solution that you think would help reduce that pollution.

(Refer to the game board for possible answers. This question may be asked for each sector—air pollution, water pollution, solid-waste disposal, and land use.)

List two or three environmental problems that you feel the United States and Asia have in common.

(Refer to the game board for possible answers.)

List one environmental problem that the United States has that you don't think countries in Asia have.

(Higher trash volume per capita or more "disposable" lifestyles, land degradation from off-road vehicles.)

Of all the environmental problems facing Asia, which one do you think is the most threatening and what would you do to reduce or relieve it?

(Encourage thoughtful, well-documented answers.)

Pretend you are living in Asia and your community has a serious pollution problem. In a brief paragraph discuss what the problem is and how you would go about organizing community support to tackle it. List several possible solutions.

(Encourage thoughtful, well-documented answers. Possible ideas—letter-writing campaigns, community forums with business partners, community-supported legislation, community watch-dog or data collection groups, product boycott, community representation on planning committees.)

Now that you have spent some time thinking about environmental problems that exist in Asia, what advice would you give a developing country to avoid having these problems? Choose one or two environmental problems associated with urbanization and discuss how a developing country might avoid environmental degradation.

(According to the World Bank study, a major source of environmental degradation is the cheap pricing of natural resources. Raising prices of natural resources to reflect the true cost of using and replacing them would dramatically reduce pollution. Students may

for the teacher

choose any one of the issues presented on the game board to discuss, as long as they document how the problem may be avoided altogether. In this question the emphasis is to think about how to prevent problems rather than solving an already existing problem.)

APPENDICES

Start!

Your mission:
to continue to improve the standard of living for
the citizens of Asia while at the same time avoiding
further degradation of the environment.



Slow Start!
Environmental
concerns need
immediate action.
Roll again!

Fast and dirty →

Privatize! Hire a private company to install and manage a sewage treatment system in your city. (+3)	You choose! Will it be the "fast and dirty" or the "clean and green" route? Actions speak louder than words!	Disappearing act! Developer gets city O.K. to start a construction project in an environmentally sensitive area that could result in the disappearance of a species. (-2)	Those pesky pesticides! Pesticides from nearby farming communities are polluting water downstream for city residents. (-3)	What's the plan? Your country passed laws for cleaner air standards 3 years ago, but no new standards have been set, let alone enforced. (-3)	Inferiority complex? Authorities O.K. new industrial complex on lake reservoir with no regard for environmental impact. (-2)	There are no short-cuts to a clean environment. START OVER!
Don't take it for granted ! Secure grant from the International Monetary Fund to support research for clean-air technology. (+2)	Clean and green →					It's the pits! Garbage collectors go on strike for better working conditions and newer, safer equipment. City government fails to respond to their requests. (-1)
You are taking the environmentally correct route. Advance 5 spaces for your unusual foresight!						Think clean! Introduce legislation to protect watershed areas and other clean-water resources. (+2)
Trashy relatives! Your aunt's private garbage collection company maintains a residential no-fee dropoff site to encourage responsible disposal of domestic waste materials. (+3)	Kudos! For your work in smog control you will receive the Otto Kleen Award , named after the pioneer of smog research! (+3)	It's all yours—to take care of! In an effort to promote responsible land use your government is reforming and enforcing land tenure laws to encourage private ownership of land. (+3)	Bravo! Your speech at the Environmental Conference about strategic planning won rave reviews! Advance 2 spaces. (+2)	Trial run! Your city was chosen to pilot a mass transit system. Planning, implementation and effectiveness studies will be included in the grant. (+3)	Go green! Your government provides significant tax incentives to logging companies who employ sustainable forestry techniques. (+3)	That " new car " smell... Your government will require pollution control devices on all new vehicles made in your country. (+3)



A **fine** statement...
Industrial manufacturers
in your city opt to **pay**
fines rather than switch
to cleaner technology.
(-2)

Out of the mouths of
babes! Schoolchildren in
your city have
implemented an
educational program on
the benefits of **kitchen**
waste composting.
(+1)

Clean up your act! Form a Water Standards Board. Enforce industrial polluters to clean up! (+3)		A local food processor has opted to "upgrade" packaging of their products to include "single-serving convenience." Convenience packaging adds thousands of tons of trash to school lunch boxes. (-3)		The land of learning! The Board of Agriculture funds an education program about responsible land use for public schools, adult education programs, and rural agricultural extension programs. (+1)		Smoking out the \$\$! Local government O.K.'d foreign auto company's plans to manufacture diesel-engine cars. (-2)		+3 Environmental 10 -3		Against the flow! Residents living in small towns along the major river in your country dispose of all waste products in the river for lack of any other trash disposal system. (-3)	
		Undermining the problem! Mining operations by river found to be source of water pollution in nearby city. (-1)		"Reincanation"! Your city awarded a contract to a foreign firm to build a metals/glass recycling facility. (+3)						Out of Bounds! The creeping boundaries of cities in your country are threatening surrounding rural land. (-2)	
				Seek help! Apply for a grant from the World Bank to study water treatment models from other countries. (+1)						Dirty water! Officials were caught accepting bribes from a local manufacturing firm. Pollution inspections were waived for \$\$ (-1)	
+3 Environmental 10 -3		Severe flooding devastates your country. Lose a turn while you wait for the water to recede.		Train 'em while they're young! Require water conservation instruction in all public schools. (+1)						Diversify! Your government offers substantial tax credits to farmers who adopt crop diversification and high-yield technologies to reduce overfarming of available land. (+2)	
		Driving news! Your child's school wins the regional newspaper recycling drive. (+1)		Get off the road! The number of vehicles in your country has tripled in 15 years. Pollution and traffic congestion are terrible and still no action has been taken. GO BACK TO START!						Time to take a breather! Your country will phase out the sale of leaded and high-sulfur vehicle fuels in the next five years. (+3)	
		Renew! Seek a grant from the Asian Development Bank to replace coal-based power sources with renewable solar, wind, and water power. (+2)		Pipe dreams! Your city has no sewage treatment facilities. Domestic sewage is dumped into a nearby river. (-3)		+3 Environmental 10 -3		New waterproof construction! Require new building projects to include water-use estimates and modern technology. (+2)		Zoned! Your city adopts strict zoning laws that encourage high-density housing to ease demands on land reserves. (+3)	
										Other people's trash! Your country's recycling attempts so far have been limited to "ragpickers" (poor people who go through other people's trash to sustain a living). (-2)	

Give credit where credit is due! Your country has established a lending fund dedicated to financing environmentally beneficial projects. (+3)	Walk in another's shoes! Trade places with any other player on the board. Add or subtract that space's points to your score.	Give 'em a break! Provide tax incentives for farmers who use modern technology to conserve water while irrigating crops. (+3)	+3 Environmental 10 3	Pull the plug! You own an auto shop that, for a small fee, permanently disables the pollution control device on autos. (-1)	Desperate farmers put tremendous pressure on the land by using poor farming practices—burning forests to clear land, using marginal land, and overfarming. (-3)	Somebody has to do it! Inspect cesspools and septic tanks for signs of leakage. (+1)
						Oil slick! Large domestic oil refinery has been dumping thousands of gallons of sludge into nearby lake. (-2)
+3 Environmental 10 3	Rank and file! Your country has requested help from the World Bank to prioritize its environmental problems and file a National Environmental Action Plan. (+2)			Omitted emissions! The leading newspaper in your city uncovered a scandal in the regulatory bureau. Certain industrial emission records had been modified and others were missing. (-2)	To Serve and Protect! A Bureau of Public Land is created to manage and protect public land in your region. (+2)	City seekers! Farmers in your country, unable to purchase or gain clear title to the lands they are farming, head for the city to seek a new life. (-1)
That's telling 'em! Your country's education program about the benefits of recycling resulted in a 20% increase in recycling collections last year. (+1)				Coal in your stocking? Your government is renewing pricing subsidies for coal—the most polluting source of energy in your country! (-3)		Nothing to sneeze at! The Emissions Board in your country has set new tough industrial air standards with tax incentives for full compliance. (+3)
Trash the budget—or budget the trash! Though solid waste per capita continues to grow with the economic expansion your country is enjoying, budgets for trash collection and landfill use remain the same. (-3)	Heavy-duty dumping! Large industrial complexes in your city dump all industrial wastes into a nearby river. (-3)			Detox now! Seek a grant from the Asian Development Bank to plan and implement safe toxic-waste disposal. (+2)		Diversion tactics! City funds earmarked for water sanitation diverted to new hotel complex. Go back 4 spaces! (-2)
Roll again! The environmental clock is ticking! The Day of Reckoning awaits!	On the road again! Your city planner gets the approval for a 1,000-home development 20 miles from your capital city—with no train or bus in sight! (-1)	Power Lunch! Your representative secured funding for two high-priority investment projects at the annual meeting of the Metropolitan Environment Improvement Program. (+2)	Plug the leak! Government officials fail to inspect your city's septic tanks and cesspools. (-2)	+3 Environmental 10 3	Time to log off! Soft policies on commercial logging to boost timber exports result in serious degradation of forest reserves. (-3)	Rush hour! You are head of Traffic Management in your region. Engineering efficient, non-congested traffic routes is your highest priority. (+1)

Day Of Reckoning

You've arrived —in a newly acquired environmental state! If you are the first one here add 12 bonus points to your score (six points for 2nd; 3 points for 3rd).



How did you respond to the environmental issues in your country? Tally up your points and find out!

As in real life, you only have limited resources. Lose one turn while you reflect upon your past actions.

Air Force One... You're elected **president** of the local citizens' environmental group. Your top priority is to pressure officials to clean up **air emissions** from industries. (+1)

Overreacting! Poorly trained technicians cause toxic spill at a nuclear **reactor**. Local population had to be evacuated and the surrounding land quarantined. (-1)

Running clean! Your government will require higher general maintenance standards on all existing vehicles to get smelly clinkers off the road. (+3)

(E)mission impossible? Government relents and allows auto manufacturers another five years to comply with new emission controls required on new autos. (-2)	Water reflections? Adjust water prices to reflect full costs of using and renewing water. No more water subsidies! (+3)	Keep a lid on it! Your city planner developed a system to monitor and enforce the safe disposal of hazardous waste. (+2)	A "No Show"! Your country failed to send a representative to the International Conference on Air Pollution. (-2)	Stay put! To prevent further mass migration to cities, your region has a plan to diversify traditional rural employment to include light industry such as parts assembly plants. (+2)	+3 Environmental 10 -3	Now you're cookin'! Implement a plan to provide rural residents with natural gas for cooking and heating rather than cutting timber. (+1)
+3 Environmental 10 -3						
Timber (prices) shooting up! The Forestry Agency in your country is reforming pricing standards for timber to reflect true harvest and replacement costs. (+3)	Don't get wasted! You're in charge of an environmental project to construct a sanitary landfill and purchase the necessary equipment to collect your city's solid waste materials. (+2)	Decentralize! Meet with mayors of large cities to initiate local monitoring and regulating of water supplies. (+2)	Stumped again? Rural residents in your country cut down trees to use as fuel for cooking and heating their homes. (-2)	A car-less life! Your city announces a new policy to offer tax incentives for developers to build planned communities to reduce vehicle traffic. (+2)	Congratulations! The Whet Noodle Company in your city was the winner of the international environment-friendly packaging contest this year! Big \$\$ prize! (+2)	Low tide in water policy! Government officials from your country offer reduced water rates to attract new industry. No charges for water recovery. (-3)

front

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dotted line, then tape ends.)

back

p. 1

Environmental I Q	Each day approximately _____ people are added to the world population: a. 5,000 b. 85,000 c. 250,000
Environmental I Q	Name one solution you studied about that could reduce air pollution in Asia. (Enforce industrial emission regulations, require pollutant controls on cars, reduce vehicle miles traveled, change to cleaner fuels for transpor- tation, heating, and cooking.)
Environmental I Q	True or False? The major cause of air pollution in Asia is emissions from industries. (False. The major cause is emissions from motor vehicles.)
Environmental I Q	Name one solution that you would implement to ease traffic congestion in Asian cities. (Build mass-transit systems, raise fuel costs, improve traffic management, plan "car-less" communities.)
Environmental I Q	True or False? In the long run, subsidizing the price of coal helps reduce the amount of pollutants in the air. (False. Coal is a "dirty" fuel. Companies that use cheap coal have little incentive to switch to a cleaner, more expensive fuel source.)
Environmental I Q	How would raising the cost of water for residents and industries help reduce water pollution? (Higher prices would encourage conservation and provide money for renewal of water resources—water treatment and sewage systems.)

front

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dotted line, then tape ends.)

back

p. 2

Environmental IQ	You are in charge of a campaign to educate the public on the need to conserve water. You decide the best way to reach the people is through... (T.V. spots, education programs in public schools, newspaper articles, community forums, information on water bills, public billboards.)
Environmental IQ	As a city planner, what information about water use do you want businesses who are proposing industrial projects to be able to provide you with? (Projected water use, actual water use, composition of water before and after use, treatment plans for used water.)
Environmental IQ	As a water regulator your job is to assess penalties for water standards offenders. Name two penalties you often assess. (Fines, plant shutdown, water service cutoff, restricted use of water, mandatory education, community service.)
Environmental IQ	Which continent will have the most megacities by the year 2015? a. Europe b. Asia (approximately 17) c. North America
Environmental IQ	Why would restricting the number of diesel-fueled cars manufactured reduce air pollution? (Diesel fuel does not burn as cleanly and completely as non-leaded fuels. Fewer diesel cars = less pollution.)
Environmental IQ	How would you improve traffic management in your country? (One-way streets, synchronized lights, separate bike lanes, straddled start/stop work schedules, carpooling, commercial vans, encourage alternate forms of transportation.)

front

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dotted line, then tape ends.)

back

p. 3

Environmental IQ	A "megacity" is a city with a population of more than: a. 10 million b. 1 million c. 8 million d. 5 million
Environmental IQ	True or False? The domestic burning of coal and wood is a leading cause of air pollution in China. (True. Emissions from residences heating and cooking with coal and wood do produce a major portion of the pollutants in the air in China.)
Environmental IQ	Why would encouraging land tenure (ownership) help reduce land degradation in Asia? (Laws in Asia make it difficult for farmers to own small farms. If farmers owned the land they farmed they would invest in practices for long-term care and maintenance.)
Environmental IQ	Why would private ownership of solid-waste companies help reduce environmental pollution? (Private companies would have to be thorough [to keep their city contract] and efficient [to make a profit]. City governments would be able to focus on the other needs of their growing cities.)
Environmental IQ	Targeting the most polluting sectors in a country should be a top priority. Which ones do you think those are? (Transportation, industries, home heating and cooking, forestry or agriculture.)
Environmental IQ	Why would encouraging public participation in planning decisions help improve environmental conditions? (People closest to the problems may be able to offer insight and help in solving them. Sharing responsibility is the key to solving problems.)

front

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dotted line, then tape ends.)

back

p. 4

Environmental IQ	Define "environmental degradation." (Environmental degradation is the undermining, spoiling, or deterioration of the natural environment by human activity.)
Environmental IQ	How many cities in Asia have populations over one million? a. 17 cities b. 52 cities c. 87 cities
Environmental IQ	What are the four main sectors or areas of environmental problems we have been studying about? (Water pollution, air pollution, solid-waste disposal, and land use.)
Environmental IQ	True or false? Dumping household waste materials in rivers is common in some Asian cities. (True. Many cities in Asia have no sewage or trash disposal system. People in those cities either bury, burn, or dump their garbage into rivers.)
Environmental IQ	Why are people in Asia moving from rural areas to cities? (Better wages, more job opportunities, build a better life, cities provide more services and choices, depleted farm soil, poor crops, unable to own land.)
Environmental IQ	The words "per capita," as in the phrase "the trash volume per capita is growing substantially," mean: a. for each capital city b. for each head of a household c. for each person

front

(Cut out cards, fold on
dotted line, then tape ends.)

back

p. 5

Environmental IQ	True or false? Today, Asian countries are top exporters of timber and forest products. (False. Asian countries used to be large wood exporters, but the depletion of forests and growing populations now require that they import wood products.)
Environmental IQ	What does it take for a megacity to be sustainable? (Cities that have sustainability are able to provide for the necessities and needs of all of their population without undermining or depleting the natural resources that support them.)
Environmental IQ	How much of the natural habitat of Asia has been lost or degraded by invasive use of the land? a. 50% b. 25% c. 75% (according to a World Bank study)
Environmental IQ	Why do you think industries are reluctant to change to technology that is less polluting? (Most businesses view the extra money it would take to change as expensive and unprofitable. They feel they would get no return on their extra investment.)
Environmental IQ	How would you encourage companies in your country to use "environment-friendly" packaging? (Provide tax incentives, special awards and recognition, special contracts, or reduced garbage costs for recyclable materials.)
Environmental IQ	How do the expanding Asian marketplaces provide opportunities for adopting clean technology? (Open markets and relaxed trade policies attract foreign investment. Foreign associations may help by providing models and know-how for cleaner technology.)

Center for Global Partnership,
The Japan Foundation

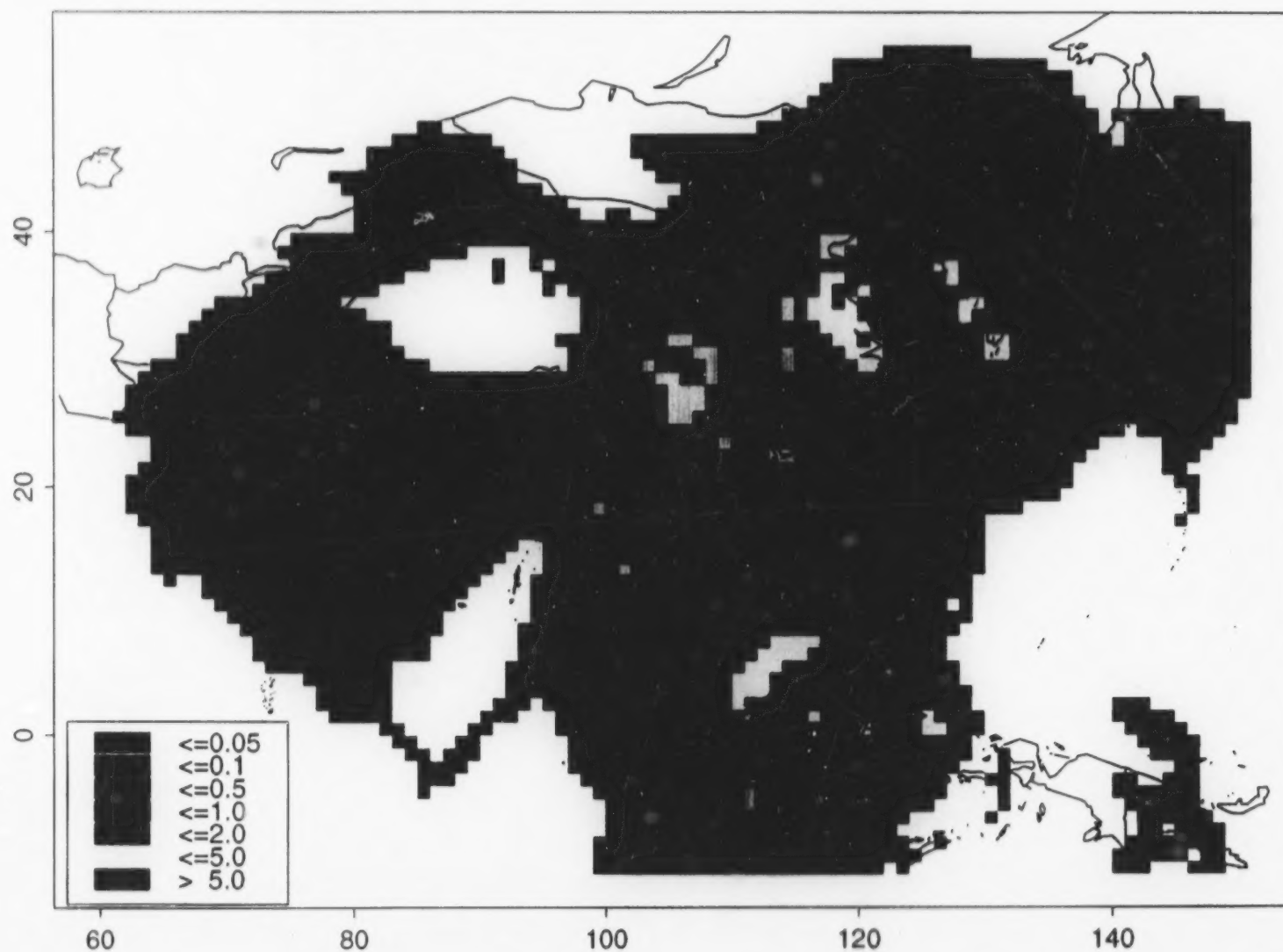
Consulate General of Japan, San Francisco

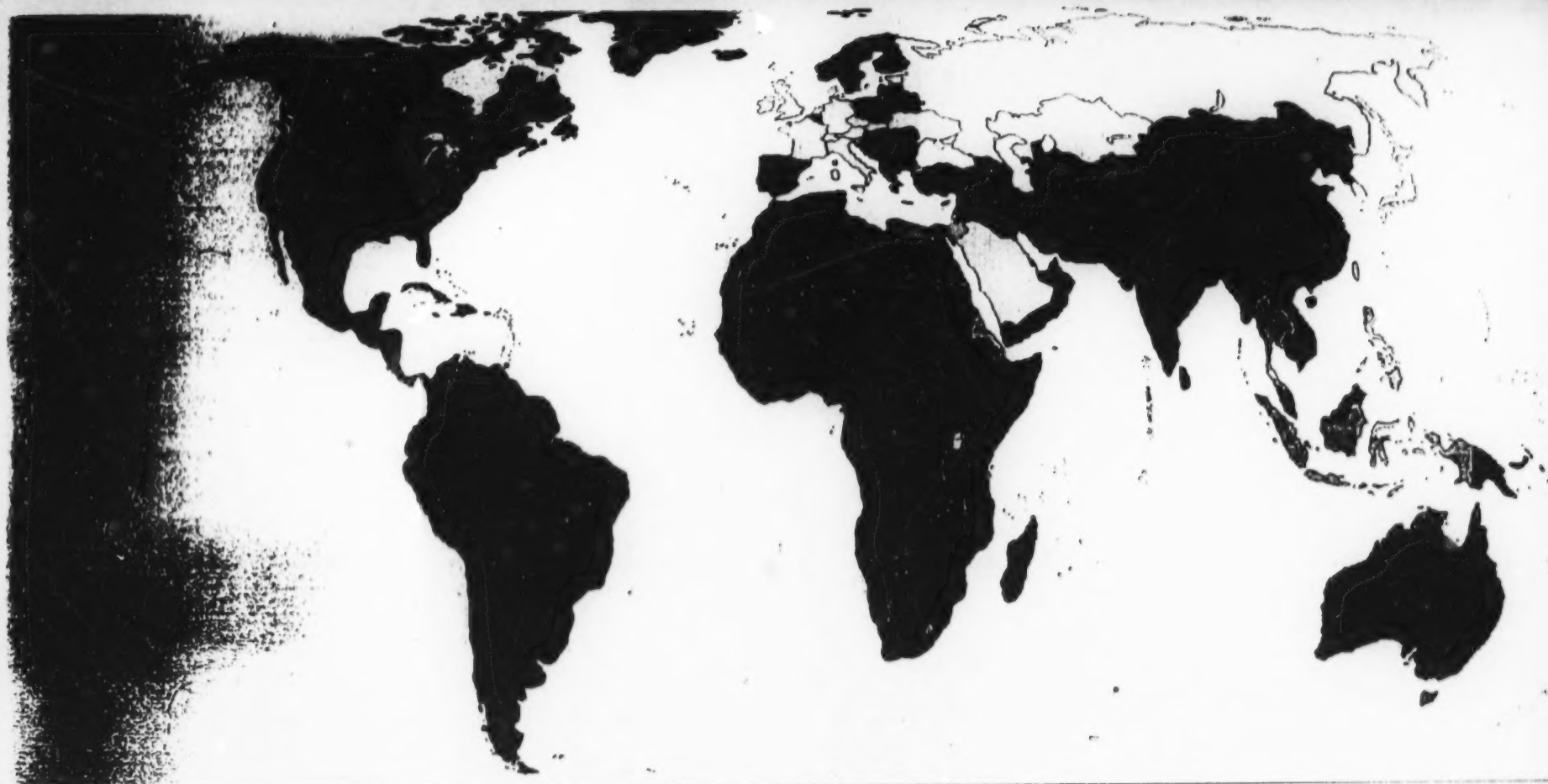
Institute for International Studies,
Stanford University

Japan Fund, Stanford University

Stanford East Asia National Resource Center

1990 Annual Sulfur Deposition (grams S/m²)





**Energy use per
capita, 1994**

-  Less than 300
-  300-999
-  1,000-2,499
-  2,500-4,999
-  5,000 or more
-  No data

159

160

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